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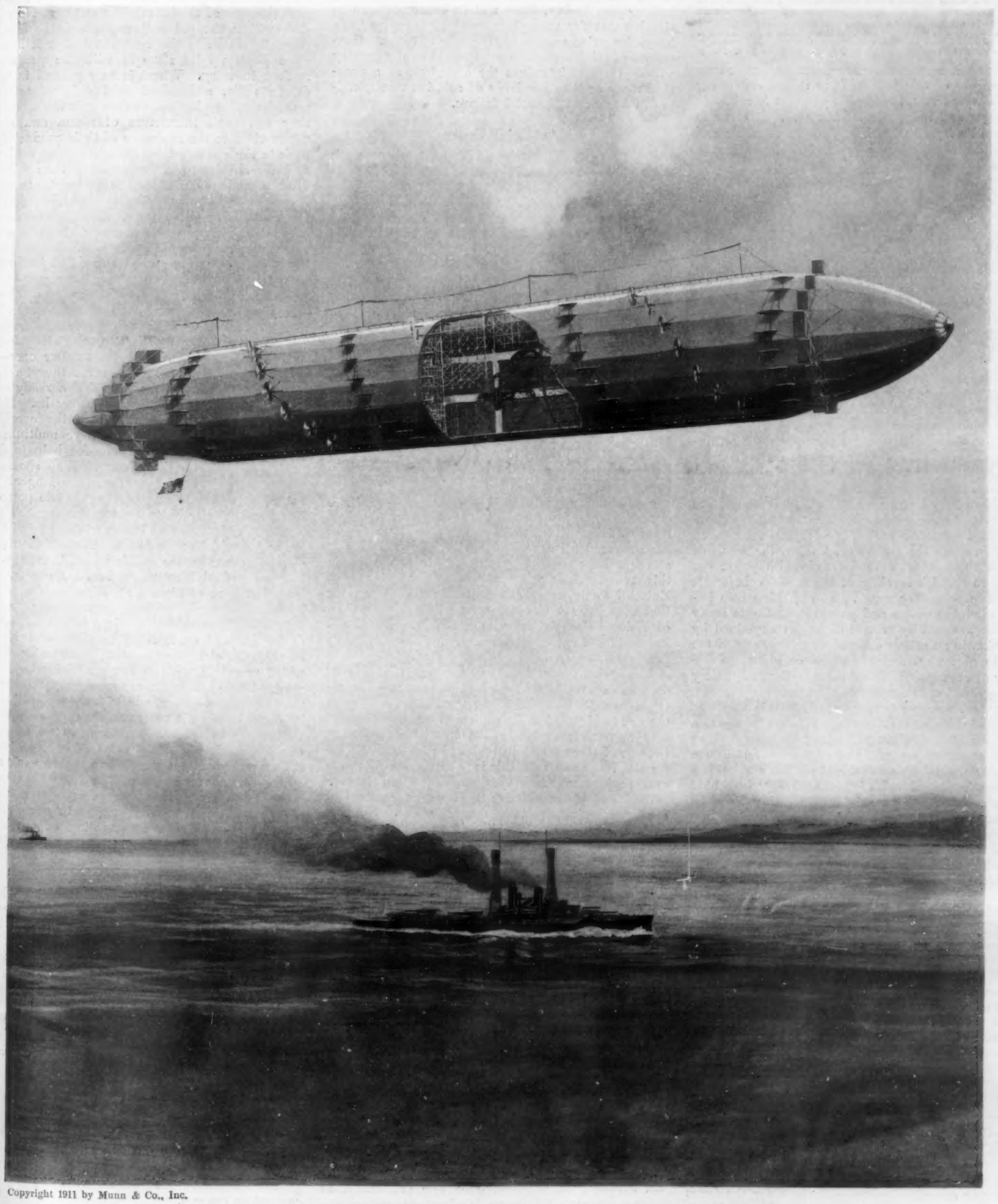

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THE GIANT AIRSHIP OF THE FUTURE COMPARED WITH A MODERN BATTLESHIP

The outer envelope has been broken away to show the interior trussing and the accommodations for passengers.—[See page 185.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Aeroplane Touring vs. Exhibition Flying

LAST week the followers of aviation in this country were given an opportunity to contrast the aeroplane as a practical means of transport across country with the aeroplane as a provider of sensational amusement.

No more striking demonstration of the utility of the aeroplane for pleasant and rapid touring could have been given than Atwood's flight, at an average speed of between forty and fifty miles an hour for the first half of his journey from St. Louis to Chicago and New York, a distance of about 1,265 miles, or double that covered by him in his memorable flight from Boston to New York, Atlantic City, and Washington some weeks ago.

On the other hand, the dangers of exhibition flying on the edge of, and over, a large body of water were distressingly brought out by the deaths from bad falls of two promising young men, both of whom, had they lived, would in all probability have contributed to the progress of aviation in America.

These two fatal accidents seem to have been caused in much the same way, i. e., as the result of a sudden descent at a sharp angle with power on, ending in a quick leveling of the machine before it struck the ground or water. The terrific strain imposed upon the planes and guys, amounting to many times that caused by normal flight (as explained by Dr. Zahm in an article on another page), caused the guys to give way, and the wings or planes to collapse, after which the aeroplane fell precipitately to the ground or the water of the lake.

The first machine that collapsed in this way was a Baldwin biplane driven by William Badger, a wealthy young amateur aviator of Pittsburg. The planes crumpled up and the aeroplane fell into a pit. As is usual in an accident of this sort with a biplane, the motor, which is mounted directly behind the man, fell upon the aviator, fracturing his skull and badly mutilating his body. He died within three-quarters of an hour.

The second fatality, which occurred only a short time after the first one, happened to St. Croix Johnstone, the leading pilot of the Moisant monoplane and the holder of the American endurance record of over four hours in the air. Johnstone had been flying for two and a half hours, most of the time over the lake, when he made a sharp descent from a height of some 1,500 feet. Suddenly, when less than 500 feet above the surface of Lake Michigan, the aviator lost control and the machine plunged into the water. Johnstone was unable to save himself in the way that Arthur Stone did under similar circumstances two days later, namely, by diving from the machine just before it struck, and he was carried below the surface and drowned. Robinson in a Curtiss hydro-biplane was flying nearby at the time. He alighted upon the water and tried to render assistance, but was unable alone to extricate his fellow flyer.

While the two fatal accidents were not due to the wind, this had much to do with several of the other disasters. The Windy City made good its name by producing exceedingly strong breezes for the flyers to battle with. One of the most peculiar accidents happened on the second day, when McCurdy's biplane is said to have caught fire from contact with some high-tension electric light wires. The machine was entirely consumed. The third day of the meet Simon, in a Blériot monoplane, and Hammond, in a Baldwin biplane, each fell into Lake Michigan. The latter dived from his machine before it struck the water, while the French aviator remained in his monoplane until he was rescued.

In making his long-distance tour Harry Atwood has shown the aeroplane, when favored with good weather, to be fully as dependable as the automobile. Besides this it is a speedier, cleanlier, and more pleasurable means of transport. The $10,000 prize Atwood expects to win, in addition to the various sums paid him for flying over towns and alighting, has made his remuneration from his ten days' outing several times greater than that of the best aviator at the Chicago meet. In addition to this, his flight has given many more people, gratis, their first view of an aeroplane.

We are glad to note that at the Boston meet, which opens to-day, there will be two cross-country circuit races for monoplanes and biplanes respectively, for prize money aggregating $17,500. Generosity of this sort by the newspapers of the country will do more to introduce the aeroplane as a practical machine than hundreds of aviation meets, ending in death and financial failure.

Artificial Frogs

A CABLE dispatch from Paris last week brought the startling news that Prof. Bataillon, the well-known biologist, has succeeded in producing "artificial frogs." Announcements such as this have become so frequent of late that they have almost ceased to startle the *blase* newspaper-reader; but whether one is startled or not, the announcements are essentially false and misleading. We are in fact no nearer the creation of "artificial frogs" or "artificial life" in any form, so far as actual control of the conditions that lead to the origin of living matter is concerned, than we were a dozen years ago.

The problems involved in the work which leads to these sensational announcements are of two entirely different kinds. In the first place we have the question of the physical and chemical processes that go on in the living protoplasm, with the attempt to reproduce as far as possible a combination of molecules that will behave in some respects as does the living matter of a cell. If we could succeed in bringing together from the bottles in the laboratory a combination of substances that would react upon one another and upon the environment as does the mass of substances we call an "Amoeba" we should have succeeded in creating "artificial life." Many attempts have no doubt been made to create life in this sense. And many attempts—from those of Butschli to those of Leduc—have succeeded so far that they have reproduced some of the peculiarities of living things in non-living matter. But Prof. Bataillon did not try to do anything like this. His problem was an entirely different kind.

He was concerned chiefly with the question, "How does the sperm cause the egg to develop?" In attempting to reduce the influence of the sperm upon the egg to physical and chemical terms, the biologist may be said to deal with the creation of life, but the use of these terms in that sense is purely metaphorical. At any rate, this is the nature of the general problem with which Prof. Bataillon is concerned, and his results are the logical successors of earlier experiments along the same line. Starting with Prof. Jacques Loeb's experiments, in which the unfertilized eggs of sea-urchins were induced to develop by the action of physical forces (osmotic pressure) and by various chemicals, passing to Loeb's later experiments in which the chemical action was analyzed further into its electrical factors, and from these to the experiments of Delage, who induced fertilization by means of electric charges, we have a continuous series of contributions to the solution of this problem. But from Delage's "artificial parthenogenesis" by means of electrical charges through the surrounding medium, to Bataillon's artificial parthenogenesis by means of electrical charges through the unfertilized egg itself, is only a step—but an important step.

In all of these experiments the biologist has before him well-defined problems; in none of them does the experimenter for a moment think that he is making "artificial life." For if we could succeed in making all frog's eggs or sea-urchin eggs develop into adults without fertilization, we should not be creating life at all; we should simply cause eggs to develop under artificial conditions. To create life we should have to provide the egg artificially, as well as the stimulus for its development.

Nevertheless these experiments are of importance, as well as of interest, for they lead not only to a better *understanding* of the fundamental processes, but also, eventually, to a surer *control* of vital processes, in animals and in plants. Without any illusions as to the likelihood of artificial frogs being sent here from France next year, or even the year after, we may still find it worth while to learn what has actually been accomplished in these two lines of research. We shall accordingly present to our readers shortly an account of the experiments made to reproduce the physical and chemical peculiarities of living matter, and those made to replace the vital action of one factor in reproduction (the sperm) by chemical and physical processes.

The Abandoned Mill and the Farmer

SCATTERED broadcast throughout our land are hundreds of water mills, long since abandoned. Relics of busy centers these, where the grind of the millstones, the clatter of machinery, and the creaking of the old water-wheel, once vied with the roar of the industrious stream. Now all is still, within the old mill walls, and the dust, the moss, the rot, and the rust, show that it has long since given up its struggle with the progress of modern industry. Wheat is now ground in steam-driven mills, a hundred fold greater, and little manufacturing plants have moved to the city, where they can avail themselves of steam and electric power close to the consumer of their products. But back in the country the idle mill stream still pours over the old dam, and dashes down the spillway in utter abandon—hundreds, may be thousands of horse-power literally going to waste—while in the adjacent fields the farmer, whom it once served, still toils at his plough and sends his grain a thousand miles away to the steam mill.

Is this really progress? Can we feel justly proud of the industrial advancement of our great nation, while such prodigality exists? But what can be done with these water-powers? A few of them, the larger ones of course, which are advantageously situated, have been set to work generating electricity for light and power purposes. But the smaller ones—have they no further value? Of course they have; and we need not look far afield to find a ready market for this power, small though it may be. Side by side with these idle streams, are the over-driven farmers, whose labor troubles have multiplied appallingly, and who are crying for help to do the necessary work on their farms. Why should such an anomalous condition continue any longer? Why not convert these old mills into electric power stations, and let electricity lighten the farmer's tasks? The first objection that comes to one's mind is that the cost would be prohibitive. That this is not so is clearly proven by the article on another page. Mr. T. Commerford Martin and Mr. Putnam A. Bates, both engineers of highest standing, outline a policy by which these fast-decaying relics may be put to some use. The capital required is not large, and a dozen farmers could band together and install a co-operative electric-generating plant in the old mill, which would furnish all the electricity they would need. The average farmer would not require more than fifty horse-power, and with a co-operative plant he could obtain his power so cheaply as to make it well worth his while. We know of no better way of utilizing the smaller streams of our country, and it does not require a prophet to see in such a plan a material advancement of the farmer's condition. The first co-operative farmers' power generating station will mark a notable step in our industrial progress, and in the conservation of our natural resources.

Another Misplaced Moon

THE long list of blunders committed by distinguished literary men in writing about the moon has received a recent addition, attention to which is called in *L'Astronomie*. A work by M. Maurice Donnay, of the French Academy, contains the following passage:

"We watched the setting of the sun. It seemed as if, in the west, metals were entering into fusion, then cooling rapidly until they assumed a uniform orange tint, while *on the opposite side*, in a sky of pale and, as it were, washed-out blue, a *slender crescent moon* appeared."

Apparently there is need of more intimate intercourse between two branches of the Institut de France; viz., the Academie Francais and the Academie des Sciences. One wonders what must be M. Donnay's outlook, in general, upon the physical universe, if he has never grasped the simple relation between the moon's phases and her position with respect to the sun.

We hope that no reader of this journal needs to be told that the only kind of moon ever seen in the eastern sky near the time of sunset is one that is at or near the full.

The United States Referee Board

How It Came to be Appointed

By Ira Remsen

IN January, 1908, the writer received a letter from President Roosevelt, the essential part of which follows:

"We have reached a point in the enforcement of the Pure Food and Drugs Act where it has become necessary that some scientific questions shall be settled. For this purpose, I have decided that we shall have a Referee Board, of five members, eminent medical men or physiological chemists. The Secretary of Agriculture will certify to this Board each question upon which he desires a final determination. Only those questions will be referred to the Board concerning which there exists a serious difference of opinion among eminent authorities. . . . The Board will have full authority to make all experiments necessary to reach a decision upon the questions submitted. A secretary of the Board and other clerical help will be provided, and the expenses incident to the investigations will be paid.

"It is my desire to secure men of such high character and attainments that when the Referee Board speaks, it will be the final word on the subject so far as the United States is concerned. The questions now pressing for solution, which will probably be referred to the Board immediately, are, whether sulphur dioxide and benzoate of soda are harmful in foods. The Board will enjoy the greatest independence. The government will certify the questions and the Board will work out the answers in its own way, free from hampering influence of any kind.

"Perhaps you know one or two men who are available. If so, I ask that you will write me fully about them; also that you will ascertain if their services may be secured, all, of course, in a confidential and tentative way. Prompt action is necessary in this matter, as the Board will be appointed within a very short time."

Having taken counsel with my colleague, Dr. William H. Welch, I wrote the President, January 17th, making some suggestions. On the 21st the President wrote me as follows:

"Won't you accept the presidency or chairmanship of that committee of five? You are the very man I would most like to have on it.

"If you will accept I will later get you to come over to see me so that I may have the chance of talking the matter over at some length with you."

On the 23rd I answered thus:

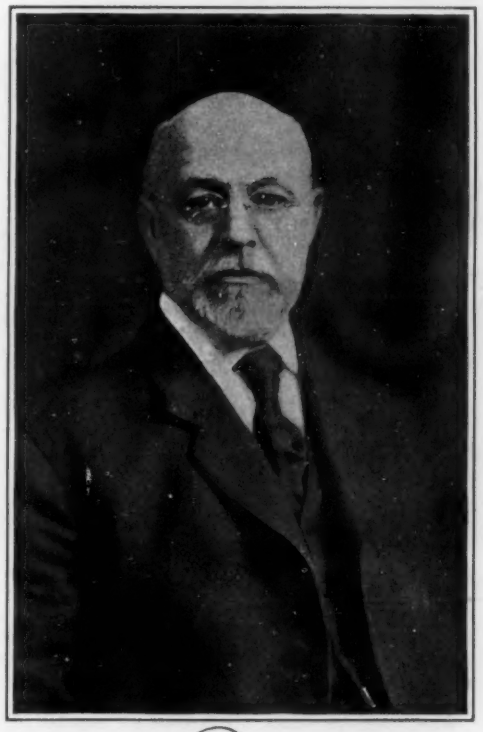
"I have given careful consideration to your suggestion and am now prepared to say that if after a conference with you, the matter should present itself to me as it now does, and I should find it possible to give the necessary time to the work, I should be strongly inclined to accept your offer.

"If you will appoint a time for an interview, I shall be glad to call on you and talk the subject over."

On the 27th I went to the White House and had a very satisfactory talk with the President. He urged me to accept the chairmanship he had offered and added, "I want you to start this work and get it under way. If you should find it too great a burden you can, of course, withdraw later." Everything he said showed clearly that the only object he had in view was to find out what the truth is as far as this might be possible. The talk between us was on the highest possible plane—refreshingly so. I accepted, and then at the President's suggestion I called on Secretary Wilson, as everything pertaining to the Pure Food and Drugs Act falls within the jurisdiction of the Department of Agriculture. My talk with the Secretary was as satisfactory as that with the President. It was clear that the Board was to be absolutely free from all external influence, that it was to work in its own way, to be, in fact, as free as the air. And let me say here, now that the Board has been in existence for over three years and has had a somewhat stormy time, that President Roosevelt and President Taft as well as Secretary Wilson have allowed us to work without the slightest interference. Our relations have, naturally, been closest with the Secretary and, as chairman, my relations with the Secretary have been particularly close, and it is a great pleasure to me to testify to his uniform courtesy and to the fine attitude he has taken toward our work from the beginning of our service to the present. Nothing could have been finer.

Now, about the appointment of the other members of the Board. The President turned over to me all the papers in his possession bearing on this subject, and then it appeared that he had written to four or five other university presidents a letter similar to the one quoted at the beginning of this article and that these gentlemen had made some recommendations. The President said to me, "You need not be influenced by these suggestions. Select the men you think best and I will see that they are appointed." After another conference with Dr. Welch I told the President that I should like to have appointed Dr. R. H. Chittenden, director of the Sheffield Scientific School of Yale University, and professor of physiological chemistry therein; Dr. J. H. Long, professor of chemistry in the medical school of Northwestern University; Dr. C. A. Herter, professor of pharmacology and therapeutics in the College of Physicians and Surgeons (Columbia University), New York, and Dr. A. E. Taylor, professor of pathology in the University of California. The appointments were made by Secretary Wilson.

It is superfluous for me to praise these gentlemen or to say a word in defense of their character or scientific reputation. No one at all familiar with the kind of work the Board is called upon to do would venture to call in question the fitness of these members. I may perhaps be permitted to say in regard to myself that I have not engaged directly in the experimental work upon which our conclusions have been based. I have acted as chairman and exercised a general supervision. Having studied medicine before I studied chemistry, and having always been



Ira Remsen

President of Johns Hopkins University and Chairman of the United States Referee Board.

interested in the problems of physiological chemistry and pharmacology, I think I am not entirely unfitted for the work I have been called upon to do for the government. I have repeatedly suggested to my colleagues on the Board that in my opinion it would be best for me to resign, but they have persuaded me against my will not to do so. While I have become much interested in the work and am convinced that it is of value to the country, I should be glad to be relieved of the burden. In this connection, let me testify to the disinterestedness of the services of my colleagues. They have given much time to the work—in some cases without interruption from one end of the year to the other—and the compensation has been much less than would have been paid these same men for the same service. In all the discussions between the members there has never been any other desire expressed than to learn the truth and nothing but the truth. I do not see how the work could have been done more honestly.

Last winter the Board lost one of its most valuable members by death. Dr. Herter, who had for some time been in poor health, finally succumbed. To the last he kept up his interest and took part in our conferences. Weighing my words, I have no hesitation in saying that I have never known a man of higher ideals. Scientific truth was almost an obsession with him. No one could have associated with him and worked with him without being the better for it.

Another member of the Board has undermined his health by too close application to the work and, though he is on the road to recovery and we have good reason to believe that he will soon be himself again, his example is a warning to the other members.

The vacancy caused by the death of Dr. Herter has been filled by the appointment of Dr. Theobald Smith, professor of comparative pathology in Harvard University, and director of the pathological laboratory of the Massachusetts State Board of Health. Dr. Smith is a member of the board of directors of the Rockefeller Institute for Medical Research, New York, of which Board Dr. Herter was also a director. It should be said that Dr. Smith was deliberately selected by the Referee Board as the best man to fill the vacancy, and that President Taft and Secretary Wilson at once agreed.

Having thus shown how the Referee Board came into existence and under what conditions it has worked and is working, but little more is called for. The Secretary of Agriculture "certifies" the questions to the board upon which he wants an opinion. It is then the duty of the Board to answer the questions to the best of its knowledge and ability, making whatever studies may be necessary for this purpose. It has nothing whatever to do with the decisions of the Department of Agriculture and is in no wise responsible for these decisions. The department makes use as it sees fit of the reports furnished by the Board.

Finally, a few words with regard to the treatment the Board has received. Attempts have been made to discredit it in the eyes of the public. Violent attacks have been made upon it. The members have been accused of a great variety of sins of omission and commission. The law has been invoked to break the force of some of the results obtained. In general there has been much gnashing of teeth. But the Board has not been disturbed by these performances, and, as long as it may continue to labor, it cannot allow itself to be disturbed by such irrelevant matters. It is important for the world that such problems as are presented to the Board should be solved, and the only way they can be solved, is by patient scientific investigation carried on with the sole object of discovering the truth. Scientific questions cannot be answered by the erratic acts of hysterical persons nor by political maneuvering.

Increase of Lung Capacity by Exercise

ACCORDING to careful tests made in a gymnasium in Bonn, the capacity of the lungs was increased by regular exercise from 3,388 cubic centimeters or 207 cubic inches to 3,803 cubic centimeters or 232 cubic inches; an increase of 12.14 per cent. In Stuttgart the average increase was found to be from 3,833 cubic centimeters or 233 cubic inches to 4,290 cubic centimeters or 262 cubic inches, being 11.49 per cent. Among the members of the Berliner Ruder Verein (Berlin Rowing Club) the increase for the heavy crew was from 5,600 cubic centimeters or 342 cubic inches to 5,775 cubic centimeters or 352 cubic inches (3.12 per cent); for the light crew from 4,700 cubic centimeters or 287 cubic inches to 4,875 cubic centimeters or 297 cubic inches, being at the rate of 3.72 per cent.

The Queer Argan Tree

AMONG the most remarkable trees of the world is the argan, which abounds in Southern Morocco, but is seldom seen elsewhere. A "forest" of argans has a curious scattered appearance, because the trees grow singly and far apart. They are very leafy, but seldom exceed twenty feet in height. The branches put out horizontally, and begin a yard above the ground. Sheep, cattle and camels feed on the leaves, and goats will stand on their hind legs to reach them, but horses and mules refuse to touch them. The wood is very hard, and extremely useful to the natives, who make charcoa' from it. The fruit, resembling a large olive, is used to feed cattle and to manufacture a valuable oil. It also furnishes the principal sustenance of many of the poorer natives.

Convert Abandoned Mills into Electric Power Plants

Electricity on the Farm Made Possible by Co-operation

By T. Commerford Martin and Putnam A. Bates

IT is not a unique situation that is pictured in the accompanying photographs: A water power once in active use, for mill purposes, is now abandoned because the business has moved to a city offering closer markets and better facilities for obtaining mill workers, while the farmers in the immediate vicinity, who would benefit immeasurably by the utilization of this energy were it transformed into electricity and delivered direct to their farms, allow it to run to waste. If this is the way opportunities are neglected is it any wonder that the country youth leaves for the city where life is more progressive and agreeable? The solution of the rural labor problem lies in making the farm an industrial establishment where head work as well as hand work will be in demand, where the help will find pleasure in their employment because of improved conditions that are at least as healthy and agreeable as can be found in the cities.

With a natural power at hand, such as these photographs show, a co-operative electric plant may be organized and sufficient energy developed to light the buildings and supply the power for a dozen farms. The methods by which this may be done have been known so long as to insure their practicability.

Almost all farmers could use electricity to advantage, were a satisfactory supply available, but few would have sufficient demand to justify its introduction for their particular cases alone. Unfortunately many men are farming without any spare resources and of them, no immediate improvements must be expected. This class seems larger than it is in reality, for the American farmer too often cares little for appearance, which accounts for the popular idea that farming must be all work and no play. There is, however, a distinct class of men in any farming section, as in the cities, who look kindly upon co-operative effort for general betterment. These are the men we must depend upon to organize our farmers' water-power electric station.

Located, as this old mill property is, in the center of a farming section having a tillable soil of average fertility and surrounded with farms averaging from 300 to 500 acres each, on which stock raising, dairying or grain farming is carried on, we have as interesting an opportunity to practise "conservation of natural resources" as one could picture.

Each farmer can advantageously use some power in and about the barns, and the more electrical power he can use, the less animal or man power will be required. Besides this, electricity will be needed for lighting, a subject much neglected on the farm.

Probably an average of 25 to 50 horse-power of electrical energy could be used regularly on each of these farms, making say an aggregate of 600 horse-power in all, a plant capacity which many rural town central stations would be pleased to possess.

Why, therefore, should not farmers get together and equip this mill as a central station power plant of their own? The property has been abandoned and could be bought for very little. Some would answer this by saying that "such matters are hard to arrange amicably, and the distances of transmission introduce difficulties."

Part of dam and spillway. Very little expense would put this in shape for power service.

Old water power mill, twenty years idle. Would serve as farmers' co-operative electric power plant.

Such things are a matter of organizing only and the distance to which electric power can be transmitted is but a question of economy. The principal elements limiting this are two: the cost of power at the generating station, and the price which can be obtained for the delivered power. The difference between these two elements must cover the cost of transmission, the interest on the investment and the profit. The cost of transmission comprises the loss of power in transmission, the cost of operating, the cost of maintenance and repair. The value of the sum total of the interest, which must be paid upon the investment, and the minimum profit which is considered satisfactory, will have much weight in determining the limiting distance of transmission. A low interest rate and a low rate of profit will, therefore, be conducive to long transmission, both of which factors would naturally be low in the case of a co-operative plant. Hence, it is reasonable to conclude that with a suitably selected system of distribution the transmission question would not introduce great difficulties.

The water power here illustrated would prove quite equal to a development of 1,000 horse-power constant minimum supply, which would be an abundance for our purpose. Within a radius of ten miles, this plant as a center, a rich and only partially developed farming country lies on all sides. To reach the most extreme point of this area, therefore, with electric service and without excessive transmission loss, suggests an economical initial potential of from 6,000 to 10,000 volts.

The questions of transmission and distribution line, right of way and construction are matters that should be carefully worked out and we will not attempt here to discuss these in detail, except to say that better examples are found in our western practice or in foreign countries than in the construction so carelessly erected by many eastern electric service companies, which, fortunately, is now gradually being replaced.

Where electric current is to be carried on overhead

(Continued on page 196.)

This old building has possibilities as a grist mill or creamery using electric power supplied by farmers' co-operative plant.

Water power quite equal to a development of 1000 horse-power.

ABANDONED WATER-POWER THAT SHOULD GENERATE ELECTRICITY FOR FARM USE

A Study of the Giant Airship of the Future

Its Probable Lines of Development

By Carl Dienstbach

THE very word *airship* implies a craft that will plow the air, much as a large ship plows the sea. From the beginning, the principles of marine navigation have governed the design of dirigible airships. Those who dreamt of great aerial crafts journeying from one inland port of call to another, and voyaging over housetops and forests, were unquestionably inspired by the performances of sailing vessels, and later, of giant steamships. There were difficulties which no engineer seemed able to overcome in placing aerial navigation upon the same sure footing as traveling by sea. The gas bag seemed too much like a huge, unwieldy soap bubble, which might be easily pricked and which could not weather a storm with the same facility as a great liner. The last ten years have witnessed a remarkable change in the attitude of the engineering world toward the dirigible. There is no reason, as experience has taught, why the dirigible cannot be made stout enough to weather any storm. Indeed, we have lately seen that the giant Zeppelins are far safer in the air than they are on the ground simply because of the impossibility of training two hundred men to act in harmony when it becomes necessary to guide the huge gas bag into a shed.

It soon became apparent that if the dirigible was to be speedy and was to have great endurance, it must be made larger than heretofore. The dirigibles of our day are some of them six times the size of the first airships that were considered practical. The larger they grew the safer they became in the air. And the larger they grew the more like the ocean steamship they became in their appointments. A modern Zeppelin or Parseval, with its huge railed-in engines, its board floor, its brass fittings, its comfortable chairs, is astonishingly like a well-equipped trans-Atlantic liner. Modern air travel has driven home the theoretical truth that as you make a dirigible larger it also grows smaller in a sense, a paradox which even engineers have only lately admitted.

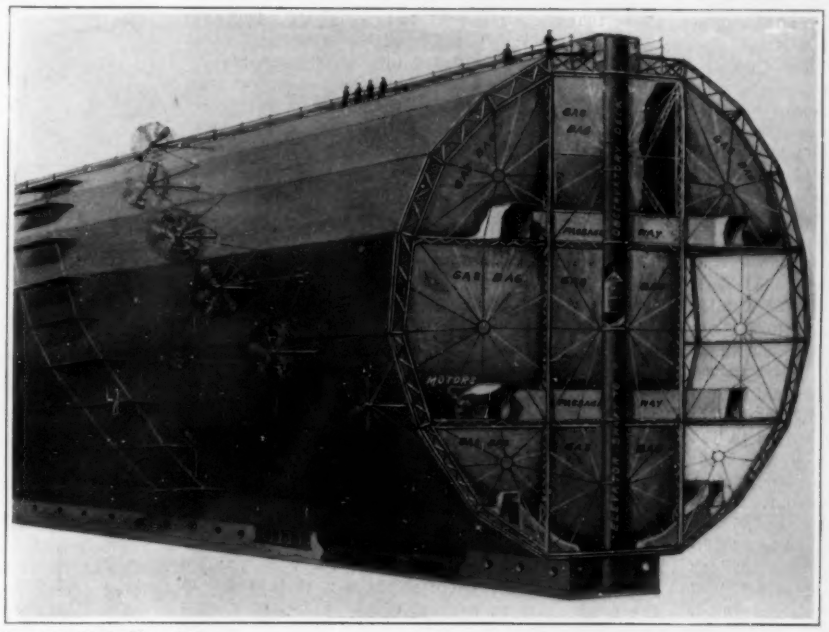
The problem of transportation consists in handling the largest load with the smallest amount of machinery possible. It is far cheaper to convey 40,000 tons in one steamer than in two, to haul a huge load by a single 425-ton locomotive than by two 250-ton locomotives. If the dirigible is ever to become a factor in the commercial transportation of cargoes it must be big. The dirigible can be increased in every direction, with a corresponding increase in lift. The aeroplane can be increased in size only in one or two planes, and then at the risk of obtaining surfaces so huge that they cannot be properly supported or easily managed.

The bigger the dirigible airship can be made, the greater are its advantages. First of all, there must be considered the increased radius of action with a single charge of fuel; secondly, there is increased speed; thirdly, there is a relative diminution of gas losses; fourthly, there is the possibility of ascending to great heights, and of profiting by wind changes at different levels; fifthly, there is the assurance that rain, snow, sleet, can have no serious effect upon the structure; sixthly, there is obtained a surface so tough and stout that no sheds are required; seventhly, there is greater safety at anchor; and eighthly, there is more comfort to passengers.

First of all we must show how the size of the airship can be increased without weakening the structure or increasing its weight inordinately, and next, how and why the eight different advantages enumerated are attained, and finally, why dirigibles of large size are more safely handled near the ground than small vehicles.

A giant dirigible could be constructed, to my mind, by combining tens, and even hundreds, of dirigibles of the present size, and bundling them into the proper shape. It is obvious that this bundle can weigh no more than the sum of the weights of which it is composed. If this bundle could be propelled by the combined force of the motors of these small dirigibles, it would obviously move much faster through the air than if each small dirigible flew singly. Why? Because the placing of many dirigibles behind one another will decrease the head-on resistance, so that the surfaces behind the bow would meet with no resistance but skin friction. It is true that skin friction is nowadays considered a serious obstacle to high speed; but a bundle of dirigibles will have less skin friction than all the dirigibles flying singly, simply because in a bundle only parts of the surfaces of the outer dirigibles are exposed to the atmosphere.

The scheme could be carried out far more easily than may appear at first blush. The load in fuel, motors, propellers, rudders, and ballast, must be so distributed that each gas bag has principally one kind to carry. The dirigibles on the outer side of the bundle would alone be provided with propellers and rudders (and the rudders would be confined exclusively to the bow and stern). These propellers and rudders would be distributed over about one-third of the outer surface. One large rudder would be excessively heavy if sufficiently strong; therefore, a large number of small rudders must be installed instead.



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Sectional view of a titanic airship with elevators to take passengers from the lower deck to the observation passageway on top of the craft.

Within the bundle will be found auxiliary machinery, dynamos, ventilators, living quarters, store rooms, and fuel tanks. Externally, the bundle will appear as a giant torpedo, with no huge car suspended below. Whatever cars there may be will be more in the nature of a continuous saloon, forming practically part of the under surface of the bundle, so as to cut down head-on resistance. Some projections there will be, such as promenade decks, bridges, observatories, wireless antennæ, and the like—all too small, however, to break the general outline. Indeed, the only projections that might cause comment (aside from the lifting horizontal aeroplane rudders) are the hundreds of propellers studding the entire surface, ranged in rows around the entire outer surface in spirals of small pitch, not unlike the rifling that runs within the bore of a modern gun. Such a spiral arrangement avoids interference of many propellers with one another, so that each may work in undisturbed air. Only the bottom surface of the bundle, to which the saloon is attached, is free from propellers.

In principle, these propellers are like those which Zeppelin has so effectively employed. They will be mounted as he mounts his, except that those near the bow and stern are to be swiveled so that they can be swung in any direction to exert a steering effect, and to assist the rudders, especially in landing.

Horizontal rudders of the multi-plane type used by Zeppelin are distributed along the flanks of this huge dirigible. Vertical rudders of the same type are clustered around bow and stern.

Most important of all are the internal arrangements of this mammoth airship. The Zeppelin compartment system of storing gas is developed to the utmost. There will be hundreds of gas cells, many "inside cars" or small gas-tight compartments to accommodate motors, machinery, stores and passengers. Special ventilating apparatus will be required to keep the air free from hydrogen so as to prevent the formation of an explosive mixture. The machinery must be so distributed that its weight will be carried by certain groups of gas cells. The walls of the gas cells are designed to form tunnels so as to provide passageways between the "inside cars." Piping and electric wiring (suitably protected) runs through the whole interior structure.

In more or less close proximity to the outer skin the gas cells are traversed by shafting from the many motors, and by transmission gears to operate the many rudders.

It goes almost without saying that the rigid system will be used in the construction of this aircraft. Theoretically, the entire complicated fabric might be held without buckling by balloonettes kept distended by blowers. In practice, however, it will be difficult indeed to use any but the rigid system. There is this point gained, however, that with this "honeycomb system" rigid construction is less wasteful of weight than in a Zeppelin. The frame does not need to be so strong, as the buoyancy of the gas itself braces the whole structure, for the bracing effect which in a spherical balloon the gas exerts only on the upper part of the envelope, is here extended over the entire structure. Nevertheless a dirigible built along these lines is subject to certain limitations as regards size. The first point which has to be considered is the necessity of keeping the balloon right side up. This forbids us to distribute the weight quite uniformly throughout the whole structure, for of course there must be an excess of weight at the bottom. This requirement introduces an element of weakness in very large dirigibles. We have here a very good illustration of a general principle, namely, that as a structure is increased in size, its weight and strength do not increase in the same proportion. For even if we only consider the ropes by which the balancing weight is attached to the envelope, as the size of the airship is increased, these ropes must be made both thicker and longer. Now their strength is proportioned to the thickness, their weight, on the other hand, to the product of their thickness into their length.

Another limiting factor is found in the internal stresses set up during any sudden acceleration or retardation. It has been tacitly assumed that each gas cell is proportioned only to take care of the inertia or momentum of the load which it has itself to carry. As a matter of fact, it must, in addition to this, bear the cumulative strain of the loads of the entire row of cells in front or behind, as the case may be. This difficulty, however, is not as serious as at first sight appears, for the mass of the outer envelope and the inner framing is so large in proportion to the surface, that very abrupt motions of the ship are practically out of the question. A third limiting factor which suggests itself, would seem to lie in the fact that the thrusts of hundreds of propellers would have to be borne entirely by a single prow, which would either be unable to sustain this stress, or else would have to be made stronger and heavier than would correspond to the individual dirigibles of which we have imagined our bundle to be composed. As a matter of fact this objection also is fallacious, and the thrust of the numerous propellers is not really cumulative, for the resistance against rapid flight arises chiefly from skin friction. Hence the thrust of each propeller is taken up mostly just at the point where it is applied—along the flanks. Nevertheless, such limiting factors as these do unquestionably preclude an indefinite increase in

size of the balloon. Yet the dimensions which are permissible are almost incredibly large. Moreover, a great advantage can be gained by neutralizing the crushing effect of any local wind pressure. This can be effected by the simple expedient of providing suitable vents through which the air pressure produced by the wind finds its way instantly into the interior of the structure. In this way the pressure against the prow in rapid flight is taken up quite as much by the rearmost internal gas cells as by the forward ones. The pressure from within is rendered equal to the pressure from outside. (The small and flimsily constructed captive balloons known in Germany as "kite balloons" are built on this plan and have weathered hurricanes that tore them from their cables but were powerless to crush them.)

The vents should be well proportioned and provided with valves, as it might be found best to limit the pressure of the wind, with the result that the strain on the side of the structure would be eliminated in spite of the hundreds of revolving propellers. The thrust of the air resistance in front is neutralized (in the material) by the pull of the suction in the rear. Thus, for instance, we may have a pressure of ten pounds per square foot upon the outside of the prow; the vents might provide a pressure of five pounds per square foot on the inside, leaving five pounds per square foot to be taken up by the material along the sides. But the vents also provide five pounds per square foot on the inside of the stern, and this pressure is not opposed by any counter force from outside, but on the contrary is assisted by a suction. This results in a pull along the sides in the material, which exactly compensates for and eliminates the compression.

As it has been conclusively shown how that the "bundle" of balloons moves faster than the component dirigibles singly, the radius of action, or the fuel supply carried, may be much increased by making the power plant weaker than the sum of the component dirigibles' aggregate power. A further decrease in power (without much lowering the speed) and in the load carried, will secure the additional advantage that the ship may be floated with partially inflated gas cells, and, supported by its aeroplane rudders, allowed to ascend to the highest levels.

The larger the volume of the dirigible, the smaller is its surface in proportion to its lift, or to the gas carried. If the air space between the outer skin or envelope and the interior gas bags, which has proved so useful in Zeppelin airships, is introduced into the design of a mammoth dirigible, it will completely eliminate all troubles arising from variations in the lifting power caused by a change in temperature under the influence of the sun's rays, or of darkness or shadows. Furthermore, it is obvious that the adventitious load which may collect upon a dirigible in the form of rain, snow or sleet, or ice, is proportional to the surface area. If this area is small as compared with the lift of the balloon, the effect of such unwelcome ballast is correspondingly reduced, and the mammoth dirigible approaches in this respect the sea-going vessel, which is practically quite unaffected under similar conditions. The numerous propellers will incidentally serve a useful function by blowing a strong blast of air along the surface of the car, whereby any snow or rain will be swept off. An obvious improvement which suggests itself would be to heat the air space around the gas bags with the exhaust from the motors, thus preventing ice from forming upon the outer envelope. By flushing this space with hot exhaust gas, or cool air, as the case may be, the balloon gas within may be rendered entirely independent of outside influences. The volume of the air space is comparatively very small, and there is enough exhaust to inflate it in a few minutes. The task is much facilitated through the fact that all the motors are in comparatively close proximity to the outer envelope, and are distributed more or less evenly over the whole structure. This device should be of great assistance in adding to the lifting power of the mammoth dirigible. For it will keep the temperature of the gas much above that of the frigid air at an altitude of three miles, for example. It is, of course, well understood that this circumstance increases the buoyancy.

One objection which perhaps arises in the reader's mind, is the danger from fire. As a matter of fact, the problem of guarding against this is no greater than that daily faced in coal mines. The Davy wire gauze screen must be used to the fullest extent of its possibilities. Its weight need be but small. First and foremost the carbureters must be inclosed in absolutely proof gauze baskets. In addition to this the entire engine room should be similarly protected. All electric insulations must be as perfect as those near the powder magazine of a warship. Exhaust tubes must be water-jacketed, asbestos-lined and inclosed in wire gauze, and the same applies to the mufflers. The gasoline tanks should be placed at the very core of the ship, far from the engines, and the fuel should be forced under pressure through slender but strong tubes of annealed copper, which would stand any vibration or shock. All joints must be welded by the autogenous process. These tubes run through small tunnels continuously flushed by a current of fresh air. The principal safeguard against fire is the elaborate ventilation system which instantly dissipates any escaping gas or gasoline fumes at any portion of the interior. The weight of these safety devices is but trifling. In point of ventilation the airship has this great advantage over the ship traveling by water, that it receives the relative wind always from the same quarter and with a never lagging force while under way. The mechanical blowers receiving the air (from the vents) already partially compressed are thus relieved of a considerable portion of their work. When the balloon is stationary the main motors become available for driving the ventilating engines. At the moorings in the harbor compressed air for the safety ventilation is taken from fixed mains through a flexible hose. A great air harbor of the future will include a blower plant similar to that of a foundry.

The complicated system for the circulation of water, air, steam and for the distribution of electricity, so familiar on large ocean vessels of our day, is not only a convenience, but becomes a vital necessity in the dirigible of the future. This safety ventilation, on the other hand, tends to increase the gas losses. If the entire structure were one great gas space, the volume of gas would be so great in proportion to the surface, and the outer envelope so thick, that the loss would be insignificant. The captive balloon at the Paris Exposition, with 25,000 cubic meters capacity, has proved this. But in the practical airship here described, the proportion of the total surface of the gas cells to their volume is just as great as for a single one of the individual cells of which it is composed, nor are the walls any thicker. However, the gas loss by slow filtration through the envelope is even in the balloons of the present day more than compensated for by reduction in fuel weight, and as a matter of fact, troublesome gas losses occur only through expansion by ascension or under the influence of the sun's rays. This last source of loss is completely overcome in the dirigible of the future. In order to avoid having to blow off gas when the fuel supply (ballast) runs low, the gas itself should be used as fuel, and not run to waste.

The cost of housing a very large airship would be a serious difficulty. But there is no reason why a balloon should not be moored in the open, provided that two conditions were complied with, both of which are fulfilled by the mammoth dirigible. The first requirement is sufficient toughness of the outer envelope, so that neither rain nor snow nor sun could harm it. The second condition is sufficient strength of structure to withstand the pressure of a gale. (As the air offers nowhere a real harbor in the same sense as a sheet of water, but only open anchorages, in an excessively severe storm an airship must simply take the same steps as would be adopted by a steamer in the open sea—raise anchor and get up steam.) The second condition is obviously fulfilled if the normal speed of the ship is equal to that of a storm. The anchor cable must of course be attached to the bow, in such way that the entire frame acts toward tension stresses as an elongation of a cable. In a severe hurricane propellers can be started to ease the strain on the cable. The strength of the structure in proportion to its bow area and the vent system provide ample margins of safety. Absolute safety will be secured by anchoring a ship to a high tower, around which it would swing freely as a weather vane. But the Zeppelin method of holding the bow close to the ground and allowing the stern to float and swing, relying on the jamming of the wind between the hull and the ground to prevent a fatal collision with the ground, also holds great promise and has the advantage of simplicity. It certainly has proved effective in very high winds. After leaving the dockyards a mammoth dirigible must remain afloat as steadily as a ship in order to be manageable. This problem presents no difficulty at the present time, being solved in the Parseval airships by the daily injection of small quantities of fresh gas. If this is effective in an airship with a single gas space, it would be even more so in a multi-cellular ship, in which the gas in the cells may be completely renewed by emptying and inflating cells alternately without decreasing the flotation more than can be readily allowed for in the harbor. In the same way entire gas cells may be removed and new ones inserted while the ship remains afloat. It may even be possible to devise a method for eliminating the air from deteriorated gas, extracting the latter from the cells and returning it to them regenerated.

A mammoth dirigible provides all the comforts of a steamer. Staterooms would be located in the interior, dining saloons, kitchens, stores, etc., near the bottom, promenade decks on the top. It is interesting to note that elevators weigh less than stairs, especially those built on the plan of modified rope ladders. Furthermore, monorails with light cradle frames running over them weigh less than passageways with walking floors. A new system of rapid intercommunication must be introduced on board the dirigible of the future to save weight and insure comfort. Incidentally it would prevent the sudden shifting toward one point of the weight of many passengers. No doubt the mammoth dirigible will prove weaker if it collides with the ground than a dirigible of to-day. But similar objections hold in the case of ships on the water, and still their size is increasing at a rate which makes us smile at the "Great Eastern" of years ago. A rowboat is but little damaged by a collision. If the "Titanic" should drift at slow speed against a rock, its steel plates would crumble like paper. If the parts of a steamer are stronger than those of a dirigible, the total weight of a steamer, which determines the crushing force, is also greater in the same proportion. Ships are placed under much the same circumstances on the water and in the air, and in either case must be jealously guarded against any possible collision. In the case of a dirigible, the danger is greatest while it is being handled near the ground, but the mammoth dirigible, after it is once launched from the dockyard shed (in absolutely quiet air, of course, as at the recent launching of the English naval dirigible), does not need to be handled near the ground because it does not enter a shed. It may be moored to a tower or upon a broad unobstructed plain by its own engine power, which is great enough to control very heavy winds. This means that with its propellers the ship can be held motionless against any wind. With the aid of the rudders even sudden gusts may be resisted, inasmuch as they cannot produce any jerky motions in a body of such large bulk. (To anchor in a severe storm is as inadvisable as it would be on the water—storms must be outridden.) The operation of landing on a plain would involve some very nice work of the horizontal rudders while the ship is driven energetically with reversed engines. The bow is dipped down toward the ground, anchor is cast, and the engines are reversed to their normal motion to ease the jerk on the anchor. Then the engines are reversed again and at the same time the anchor is hauled in. In this way the anchor is made to bite the ground so firmly that it will still hold even after the cable has been shortened from 20 to 30 feet (this terminal portion of the cable being made twice as strong as the rest). The propellers are kept revolving until the anchor has been permanently secured. A flexible "gang plank" is dropped to the ground from the bow, while the ship's stern remains floating high in the air. Very similar maneuvering has been successfully used on the Zeppelins. Keeping some of the propellers revolving with reversed motors is of course an excellent way of guarding against any collision of the bow with the ground, even in heavy and irregular gusts, while thus anchored.

If the airship is to be made fast to a tower it must be skillfully brought near the top of the tower, best by drifting past with the wind, at a moment when the wind is fairly steady. Several attempts may be necessary before success is attained. In this case also it may be a good plan to keep some of the propellers revolving in the reverse direction.

Fantastic as this mental picture of the giant airship of the future may appear to us with our present notions of aerial navigation, when we think of our sky scrapers and the 50,000-ton leviathans plying the sea, it appears that the picture here drawn is well in accord with the modern tendency, and in fact it is to be expected that the 1,000-foot airship will make its appearance before very long.

The Opium Problem in Parts of China

SOME unexpected results are found from the movement against the production of opium in China. In the Yunnan, one of the provinces where opium was produced in large quantities and at a low price and where a great deal of it was consumed, it appears that the poppy is no longer cultivated, owing to the recent measures, and the poppy fields have quite disappeared, according to the statements made by Drs. Talbot and Rigaud. However, this has had a disastrous effect on the honey culture of the region. In fact, the honey from Yunnan was renowned for its quality, but as the bees find no more flowers, the production of honey is stopped as well. The new crops which replace the poppy, such as wheat or peas, are not such as will give a honey yield as well. On another side of the question, it appears that the habits of the population are not suppressed by the present legislation, as some supposed would be the case, but according to Dr. Talbot, opium-smoking is again on the increase.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Audibility of the Aurora

To the Editor of the SCIENTIFIC AMERICAN:

If your paper is interested in the above question, you can easily set Prof. Tromholt right by sending one of your staff to St. John, N. B., or Halifax, N. S., during the fall months, or better in the early winter, and he will then hear the sounds from the aurora, and perhaps it is possible to phonograph them.

I have heard those sounds thousands of times, particularly on very cold and clear nights, while living in St. John thirty to forty years ago.

They sound like the swishing of switches through the air, and at times like the detonations of small fire crackers; at other times they sound like distant musketry, as if firing away from the heaven.

The sounds, as I remember them, do not appear unless the aurora is moving, which happens often enough for observation.

New York city. R. FLAHERTY.

A Plan to Protect the Poor Inventor

To the Editor of the SCIENTIFIC AMERICAN:

As I believe that a meeting of the International Congress of the Union for the Protection of Industrial Property is soon to take place, I take the liberty to submit some suggestions that I trust will be useful and worthy of consideration.

It is a well-known opinion among a majority of manufacturers and inventors of limited or liberal means, that the term of a patent is at present too short. It is also well known that the protection as to right of priority of invention is not as perfect as it should be. The manufacturer, when he files an application for a patent, has the capital necessary to put the article on the market and to fight through the courts not only the infringers but such patents as are in the way, even though they do not fully infringe. The inventor of limited means, at such times, lacks perhaps the experienced experts of the manufacturers that are ever ready to give any testimony in litigation to prove priority of invention or other facts; and at the best all that said inventor can secure, with his more honest but poorly defended evidence, is of very little importance and hardly satisfactory.

To remedy the above two conditions I suggest:

1. That the term of a patent be extended to twenty years.
2. That the first and final patent fees be $20 each.
3. That each patent thus issued shall be renewable for ten more years upon the payment of a tax of $200.
4. That a second renewal be allowed to each patent upon the payment of a tax of $300.
5. That each inventor, to prove his priority of invention, be allowed to prepare his own rough sketches in secret, as the development of the invention progresses, said secret sketches to be presented for sealing to a judge or other high official in the district in which the inventor is located at the time.
6. That the sealing before the judge or official be made under oath after the payment of a tax of $1, the sealing being of such a prescribed character that it will not disclose the nature of the invention at the time, and will prevent interference with the contents of the package after sealing, and that will also indicate the date of sealing, the district where the sealing took place, and the name and position of the official sealing said secret sketches, which may be identified hereafter by the term "Priority Proofs."
7. That the inventor be allowed the option of holding said priority proofs or of filing them in a special department in the Patent Office.
8. That said priority proofs shall not be examinable, when filed, until the time of the filing of the formal patent application, and then only after a request to that effect by the applicant.
9. That an inventor be allowed to secure as many such priority proofs as he may deem advisable.
10. That the presentation of the earliest or of all of said priority proofs, secured for one invention, under the proper seals, shall be considered as *prima facie* evidence in any dispute of priority or technicality arising during the examination or litigation of any patent case.

It can be seen from the above that if A has an invention fairly well defined in its form, but still subject to a series of developments, he can under oath secure, without disclosing his invention, a priority proof under the seal, date and signature of a judge or other high official, and thereafter follow the development of his invention for a period of time until it is ready for the formal filing at the Patent Office, the inventor feeling all this time his work is under protection of priority.

This will also help many inventors that cannot afford at the time the expenses of a patent application, giving them the opportunity to save or raise such moneys after they have sealed their priority proofs and assured their inventive rights.

The priority proofs are not examinable, and, except for the filing, they will cause no extra work to the Patent Office, until requested by an applicant filing a formal patent application.

The priority proofs will tend to eliminate the abuses of expert testimony, at present experienced in certain patent litigations.

Another point I wish to call to your attention is the lack of patent protection accorded Americans in foreign countries under their present laws.

While we issue a patent for seventeen years without yearly taxes except the initial fees of $35, most of the foreign countries issue patents for fifteen years for an initial fee like our own, but subject to a yearly tax on each patent as well as working clause.

Both of the above features are objectionable to the interests of the American inventor and manufacturer, and there is no reason why we should allow the privileges under our laws to the foreign patentees whose countries refuse to allow similar privileges to our inventors.

The loss to our ingenuities and industries is pronounced. An inventor having a valuable invention, patents the same abroad. In trying to sell it, when he cannot manufacture it himself, he experiences much delay at the hands of certain manufacturers, with the result that the working time limit comes right upon him. After such time, his patent being belittled in value, can be and is fought, and declared null and void, and thereafter every manufacturer abroad reaps a harvest upon the hard labors of American ingenuity.

In consequence, the American finds it difficult to control many an article in the foreign markets, and very often hard to compete with similar productions of such market.

Even manufacturers that, for certain reasons, have found it impossible to manufacture their patented articles abroad, have had their patents abrogated and lost considerably thereby.

At the same time, a foreign manufacturer can secure a patent in this country under the liberal system, manufacture the article in his own country, at low cost of labor, and importing it here and selling it at a lower cost and better profit than in his own country.

This also explains, in part, why a number of the foreign countries are not so often subject to the periodical industrial retardations that are so current in this country.

The inventor with limited means possibly finds himself, after delayed negotiations or litigations with foreign manufacturers, unable to pay the taxes, and the loss of the patent is the result.

It would be a very patriotic and conservative policy on your part to urge legislation to the effect:

1. That the citizens of a foreign country, not residing in the United States, and whose country issues patents to American citizens under the time limit clause and yearly tax clause, shall be able to receive and hold their patent rights in this country only upon working their invention in this country within three years from the time of the issue of the patent and upon the payment of a yearly tax of $20, beginning from the second year.
2. That upon the failure of the patentee to work his invention within the prescribed limit of time, his patent shall be open to contestation and annulment.
3. That upon the non-payment of the yearly tax, said patent shall be declared null and void.
4. That the citizens of such foreign countries as accord to the American inventor the same privileges that are accorded by the United States laws to its own citizens, shall be exempt from the working clause and the yearly taxation.

These points when brought to the attention of the foreign delegates at the coming convention may prompt them to suggest or formulate modifications as well to their respective laws as to the Union of Industrial Property clauses that would be more favorable to the American inventor and manufacturer.

The foreign countries can easily suspend the working clauses and yearly taxes, and if they need the money from such taxes they can make it up by increasing the initial filing fees.

They can easily realize that by removing the above objectionable clauses from their laws they will encourage invention to such an extent that the initial fees of the increased number of patent applications will more than compensate for the change.

A great majority of the American inventors would, under the new conditions, file foreign applications, while at present they do not care to do so because of the existing uncertainties.

I trust that these suggestions will receive the approval of a great many inventors, and therefore will attempt to give the American inventive public an opportunity to take up the subject and debate upon the merits and demerits of said suggestions.

It is the cause of the inventor with limited means that must be progressed, for they are the pioneers in all great things, as is evidenced by the manufacturers looking to them for meritorious inventions more than to their own experimental staffs.

The time is now ripe for such a move on your part, and I therefore urge you to give due attention to the matter, presented, as it is, as a conclusion of views given by inventors, manufacturers, and attorneys.

New York city. H. B. T.

Electric Fans for the Sick

To the Editor of the SCIENTIFIC AMERICAN:

A subscriber to your paper has written us, calling our attention to a short article in your issue of July 22nd entitled "Electric Fans for the Sick," the same referring to the practice of The Electric Supply Company at DeKalb, Ills. This gentleman, it seems, had heard of the order issued to all of the electric properties under the control and management of H. M. Byllesby & Co. early in July, directing that electric fan service be furnished free to all invalids who were unable to pay for the service, upon presentation of the proper certificate from attending physician. This order meant that in 106 cities and towns in the West, Middle West and South, any indigent sick person might obtain fan service during the hot months absolutely free, the local company not only providing the fan, but extending the service lines and temporary interior wiring where necessary, and furnishing current. This action has resulted in a great deal of favorable comment both by press and public, and in nearly every city from six to eight fans were immediately placed in commission under the terms mentioned.

The idea so far as we can learn originated with the electric light and power company at Rochester, New York. As soon as Mr. Arthur S. Huey, vice-president of H. M. Byllesby & Co., heard of it he immediately issued the order described above, which directly reaches invalids in a total population of nearly one million people.

H. M. BYLLESBY & CO.
By W. H. HODGE, Publicity Manager.

The Postal Aeroplane

REPORTS come from England and France that the official postal aeroplane for the rapid transport of mail matter is soon to become an actual reality. On August 13th Pierre Vedrines, the veteran aviator, winner of the prize for his recent notable aerial trip from Paris, France, to Madrid, Spain, made one of ten flights to demonstrate the possibility of an aero mail service. This flight was most successful. He left Issy-les-Moulineaux near Paris with mail aboard at 5:07 P. M. and reached Deauville, near Trouville, 112 miles from Issy, at 6:50 P. M., or one hour and forty-three minutes, or at the rate of a trifle over sixty-five miles an hour. The time of the fast express train going the same distance is 3 hours and 12 minutes, or 1 hour and 19 minutes longer.

On the way Vedrines dropped letter packages at Mantes-sur-Seine, Evreux and Lisieux. It is said he was paid five hundred dollars for the flight, which would average a trifle less than $5 per mile.

In London the Post Office Department is making preparations for the early inauguration of a special aerial postal service to be carried on between London and Windsor a distance of twenty-one miles. Special aerial post boxes are to be placed in public places, in which letters for this service must be deposited the same as in ordinary boxes. Collections by carriers will be made in the usual way and deposited in a central location, from which the aeroplane will depart. There the mail will be placed in sealed letter bags and the latter strapped on to the aeroplane. The flight to Windsor will occupy about half an hour. From Windsor the mail will be forwarded by train to its intended destination. King George has given permission for space in Windsor Park to try out this experiment, which is to last a week and perhaps longer.

The time is now at hand when it would be in the line of progress for congress to make appropriations for an experimental aerial postal service between two cities, as for example between New York city and Philadelphia, providing for hourly flights each way. Operating at a speed maintained by Vedrines in the Paris experiment, a letter could be sent from New York in the morning to Philadelphia and the sender receive an answer in the afternoon.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

The Man of Glacial Europe

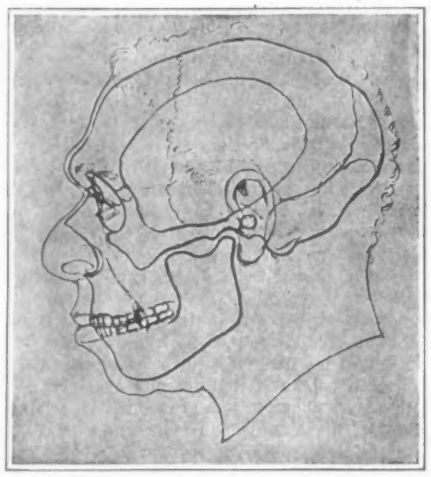
THE man who can point to a line of distinguished ancestors from whom he is *descended*, usually sees in the fact an object of self-gratification. It would seem more logical if he took pride in showing that he has *ascended* from his progenitors, though perhaps he might hesitate to decorate the walls of his dwelling with the portraits of such rude forbears as are shown in our accompanying illustrations. Dr. Keith, writing for the *Illustrated London News*, presents as follows the most modern views with regard to the earliest traces discovered of man's habitation upon this earth:

In recent years our knowledge of the human inhabitants of Europe during the Glacial period has increased rapidly. It is over fifty years since the first trace of him was found at Neanderthal, in South Germany; before that, although it is only recently we have got to know the fact, he had been found in Gibraltar: the skull then found, on the whole the most perfect yet discovered, is in the Museum of the Royal College of Surgeons of England. In recent years three wonderfully instructive skeletons have been found in the southwest of France, in the valley of the Dordogne, and have attracted much attention. Remains of the Neanderthal man have also been found in Belgium—the famous skulls of Spy—and in the southeast of Europe—at Krapina, in Croatia. And now, thanks to the researches of the Société Jersiaise, remains of this race have been found in Jersey. In a cave in the cliffs of St. Brelade's Bay, on the south coast of the island, his hearths, his characteristic flint implements, and his unmistakable teeth have been discovered.

A recently rich man must find occasionally, when proper investigations are made, that his remote ancestors are infinitely older and more respectable than he had formerly reason to believe. It is becoming more and more apparent that this is the case as regards modern man. The discovery at Galley Hill showed that our modern type was in existence in England soon after the glacial period had vanished—a period of several hundred thousands of years. Glacial man is much older. His lower jaw, with a complete set of teeth, was found four years ago near Heidelberg in a stratum which lay eighty-seven feet from the surface, and was mixed with remains of extinct animals. The age of the Heidelberg individual has been assigned to one of the first temperate interludes which broke the prolonged period of intense cold in Europe. At so early a period—one which makes the age of the Galley Hill man a comparatively recent one—we expected, on the Darwinian theory, to find man in a transition stage, a man-ape or ape-man—a pithecanthropus. That conception has dominated the artist when he has sought to reproduce the form of the Glacial European—or, to use a more strict geological term, Pleistocene man. A little over two years ago, a graphic reconstruction of the man just then discovered at La Chapelle-aux-Saints appeared in these pages. The anthropologist and artist have pictured his mouth, his teeth, his nose—indeed, the whole of the lower part of his face—as very similar to the same parts in the gorilla. In representing his attitude, his posture, his feet, legs, arms, and skin, they have drawn largely on the same animal.

When, however a careful study has been made of his skull, his teeth, and the bones of his body, it becomes very evident that there was very little more of the ape in the Neanderthal type of man than in his modern representative. He had certainly, as may be seen from the drawing by Mr. Forestier, very striking peculiarities. His face was long, wide and heavy, with rather massive jaws, but his teeth, as regards their crowns, were no bigger or different in shape and size than we see now in many primitive native races. The eye-sockets were loose, and the eyes seemed deeply set owing to the great over-hanging beetling forehead, and the nose was wide, prominent, large, quite unlike the same organ in negroid races. His brain was not small; in most cases it appears to have been above the average of modern Europeans. Some of his worked flints show great dexterity. His arms and hands were muscular, roughly molded and strong, but used, if one may judge from their shape, much in the same way as we use ours. He stood a little over five feet in height. There are no features in the bones of the lower limbs to suggest a posture or a manner of walking materially different from those of modern man.

His mouth and tongue were larger than ours, and the impressions on the lower jaw for the muscles



The "modern" man of half a million years ago; his skull and his features.

concerned in speech differ so markedly from those seen on the mandibles of modern man that we must conclude that, if speech were present, then it must have been of a primitive nature and different from the vocal articulation of modern man.

Most of the remains of the Neanderthal man, like

"The man of from one to two hundred thousand years ago."

According to Mr. R. S. Lull; an ingenious scientific reconstruction.

those recently found in Jersey, have been unearthed from the floors of caves, so that we have no means of judging what period of time may have elapsed since the remains were deposited there. In the case of the Heidelberg man, however, we have some grounds, and from the depth and nature there of the strata some estimate can be formed of the extreme antiquity of the Neanderthal race. Layer on layer has been laid down by the action of running fresh water, until the deposit in which the Heidelberg man was embedded lay eighty-seven feet below the surface. The rate of deposit we have as yet no accurate means of estimating, but few geologists would assign a period of less than 500,000 years, and most would give a larger figure.

It is becoming thus apparent that not only is modern man of great antiquity, but the earlier stages in the evolution of man have been passed through at a much earlier period of the earth's history than we had formerly any conception of. It must be remembered, too, that the Glacial period extended through hundreds of thousands of years; so far as we know, the Neanderthal type persisted throughout the whole of that time in Europe. We must expect, however, to find much individual variation in so vast a period of time; race must have succeeded race, as has ever been the case among living things. Presently we shall be able to recognize the older and more primitive from the later and more evolved races of Neanderthal Man.

Declared to be a misconception.

A reconstruction (of two years ago) of the man of La Chapelle-aux-Saints

OUR RUDE FORBEARS

Photographs by courtesy of the *Illustrated London News*.

Poisoning by Illuminating Gas

THE French journal *L'Electricien* has been gathering some interesting statistics in regard to cases of poisoning by illuminating gas. It appears that for several years past the number of such cases has been rapidly increasing. In New York alone there were nearly two thousand cases in one year, many of them fatal. The reason for this increase is traced to the change in the composition of the gas used for illumination, especially with respect to the amount of carbon-monoxide present. Different kinds of gas contain different amounts of this gas, as shown by the following table:

	Percentage of CO.
Coal gas	6.6
Oil gas	10.0
Water gas	40.0

From these figures it is seen that coal gas is the least harmful kind, and that water gas—made by passing steam through red-hot coke—is the most dangerous. For the purpose of saving the cost—or of increasing the profits—manufacturers have from time to time mixed varying proportions of water gas with coal or petroleum gas. As the water gas is odorless its presence is not readily detected; and when it is mixed with coal or oil gas a large quantity of the mixture may escape into the air without being noticed. In many communities and states the use of water gas is prohibited for this reason.

Frost Cartridges

IN the *Monthly Weather Review*, April, 1911, Professor A. G. McAdie describes a new device for protecting fruit trees from frost; viz., the "frost cartridge." Just as orchard heaters marked a distinct advance over the old-style open fires, which warmed up all out of doors, so it is believed that these cartridges, which can be used in close proximity to the fruit to be protected, will prove to be more effective and economical than heaters placed on the ground.

The cartridge consists of a cylindrical tube of heavy cardboard or other suitable slow-burning material, which is filled with a mixture of crude oil, gravel and sawdust. Two stoppers are provided to close the ends of the tube. When filled, the cartridge is suspended by a wire about three feet below the fruit. When used, the stoppers are removed and a torch is applied to small amounts of cotton waste, which have been soaked in kerosene and placed at the ends of the cartridge. A cartridge case two feet long and one and a half inches in diameter will burn about two hours. If the combustion is good there will be nothing left but the gravel and a small residue of charred cardboard.

The tubes may be filled during the afternoon hours, although it is found that they will hold the oil without leakage and without softening for several days.

There are two objections to the use of this device in its present stage of development: (1) the danger of fire from the burning ends, and (2) the large amount of soot given off, a portion of which is deposited upon the fruit. Experiments are in progress looking to the atomization of the crude oil so that combustion will be improved.

Stress in Aeroplanes in Curvilinear and Fancy Flight

The Mechanical Significance of Aerial Antics

By A. F. Zahm

OF the many dangers encountered in aeroplaning one of the most clearly defined, as also one of the most seductive, results from fancy flying—from wheeling round sharp horizontal curves, from conic spiraling, from cascading, swooping and undulating in vertical plane curves. The danger is particularly alluring to reckless young aviators engaged in public exhibitions, partly because they do not adequately appreciate the risk, partly because of the intrinsic charm and delight of such varied motion, and largely no doubt because of the liberal applause received from the admiring throng and the reciprocal desire to please that throng, too captivated by the fantastic grace of curvilinear flight, and by the bravery and abandon of the impetuous airman, to realize the hazardous nature of his fascinating maneuvers. Singularly enough the exact magnitude of such hazard, or say more accurately, the increased stress in the machine, though beyond the approximate guess of the practical aviator, is capable of nice computation in terms of the speed and curvature of flight. It seems important therefore to place the computations in ready form before all persons concerned in such maneuvers—the reckless pilot, perhaps with a wife or family dependent upon him, the applauding spectators who encourage his daring, and the cautious manager or company that, for reasons manifold and obvious, wishes to avoid disaster both to the man and to the machine.

During his recent exhibition in Washington, Mr. Glenn H. Curtiss found difficulty in restraining one of his intrepid young aviators from executing various hair-raising maneuvers. The boy loved to frolic in the air like a swallow or bird of prey, to the joy of a light-hearted throng, except possibly his wife and friends. He would plunge from a great elevation to acquire the utmost speed, then suddenly rebound and shoot far aloft. He would undulate about the field like a galloping horse, or an impetuous torrent vaulting over rocks or a rugged bed. He would bank his machine till its wings stood apparently vertical. Mr. Curtiss solemnly warned the aviator and earnestly restrained him, pointing out the danger of sweeping sharp curves at high speed. He then turned to me and expressed the wish that some one would determine exactly the amount of the added stress in curvilinear flight. The following paragraphs embody my response to his wish. With the death of St. Croix Johnstone fresh in the public mind, let us hope that they may be taken to heart by pilots who strive to please the multitude.

When a body pursues a curvilinear path in space the centripetal force urging it at any instant may be expressed by the equation:

$$F_n = m\ V^2/R \text{ (absolute units)}$$

$$= \frac{m}{g} V^2/R \text{ (gravitational units)}$$

in which F_n is the centripetal force, m the mass of the body, V its velocity and R the instantaneous radius of curvature of the path pursued by its center of mass. Since the mass may be regarded as constant for any short period, the equation may be verbally expressed by this simple law: the centripetal force varies directly as the square of the velocity of flight and inversely as the instantaneous radius of curvature of the path.

In applying the above equation to compute the stress in an aeroplane of given mass m, we may assume a series of values for V and R, compute the corresponding values for F_n, and tabulate the results for reference. In such manner the following table was obtained. It may be remarked that, on substituting in the equation, V has been taken as so many miles an hour, R as feet, and g as 22 miles an hour, for convenience, this being 32.1 feet per second.

This table shows at a glance the centripetal force

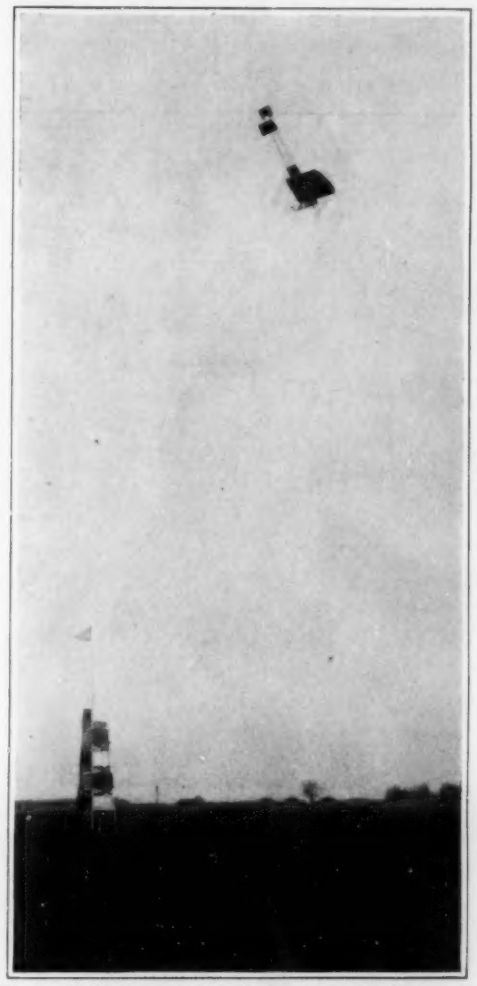


Fig. 1.—A "staircase" drop that strains a machine to the danger point when the path is straightened out in alighting.

Fig. 2.—A simple device to reveal the transverse acceleration of the aeroplane in flight.

Centripetal Force on an Aeroplane for Various Speeds and Curvatures of Flight.

Velocity, V, of the Aeroplane.	Radius of Curvature, R.				
	Ft. 100.	Ft. 200.	Ft. 300.	Ft. 400.	Ft. 500.
Miles per Hour.	Weight.	Weight.	Weight.	Weight.	Weight.
30	0.41	0.20	0.14	0.10	0.08
40	0.73	0.36	0.24	0.18	0.15
50	1.14	0.57	0.38	0.28	0.23
60	1.64	0.82	0.55	0.41	0.33
70	2.23	1.11	0.74	0.56	0.45
80	2.91	1.45	0.97	0.73	0.58
90	3 68	1.84	1.23	0.92	0.74
100	4.55	2.27	1.52	1.14	0.91

acting on an aeroplane, as a fractional part of the gravitational force, or weight, of the machine and load. If, for example, the flier is rounding a curve of 300 feet radius, at 60 miles per hour, the centripetal force is 0.55 of the total weight. At the excessively high speed of 100 miles an hour and the extremely short radius of 100 feet the centripetal force would be 4.55 times the weight of the moving mass. The pilot would then feel heavier on his seat than he would sitting still with a man of his own weight on either shoulder. Again for speeds below 60 miles an hour, and radii of curvature above 500 feet, the centripetal force is below one-third of the weight.

The entire straining force on the aeroplane in horizontal flight being substantially the resultant of the total weight and the centripetal force, can be found by compounding them. Thus in horizontal wheeling, the resultant force, as seen from Fig. 4 (page 196) is approximately:

$$F = \sqrt{F_n^2 + W^2}$$

In swooping, or undulating in a vertical plane, the resultant force at the bottom of the curve has its maximum value:

$$F = F_n + W$$

and at any other part of the vertical path it has a more complex, though smaller, value which need not engage us here.

It is obvious from the foregoing discussion that the greatest stress in the machine occurs at the bottom of a swoop, if the machine be made to rebound on a sharp curve. The total force $F_n + W$ sustained at this point may be found from the table, if V and R be known, by adding unity to the figures given, then multiplying by the weight of the machine. For example, if the speed should be 90 miles an hour and the radius of curvature 200 feet, the total force on the sustaining surfaces would be 2.84 times the total weight of the machine. In this case the stress in all parts of the framing would be 2.84 times its value in level flight, when only the weight has to be sustained. The pilot would feel nearly three times his usual weight. We may conclude from the foregoing investigation that in ordinary banking at moderate speeds on moderate curves, the additional stress due to centripetal force is usually well below that due to the weight of the machine, and that in violent flying the added stress may considerably exceed that due to the weight of the machine, and may be dangerous, unless the aeroplane be constructed with a specially high factor of safety. But there is nothing in the results here obtained that seems to make sharp curving and swooping prohibitive; for if the framing of the machine be given an extra factor of safety, at the expense may be of endurance and speed, it may be made practically unbreakable by such maneuvers, and still afford to the operator and spectators alike all the pleasures of

(Continued on page 196.)

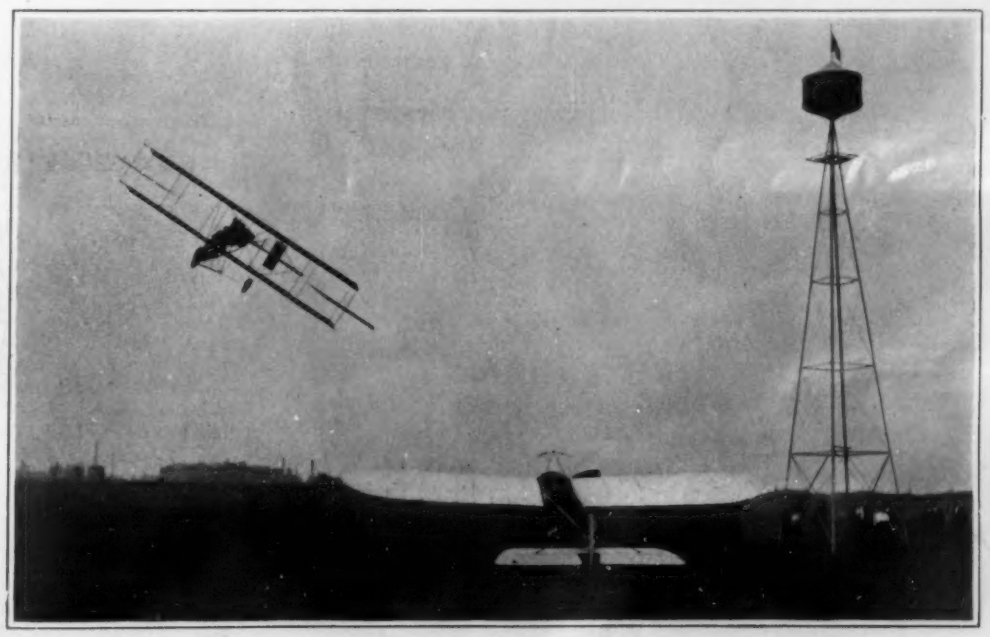


Fig. 3.—At moderate speeds on moderate curves the additional stress due to centripetal force is usually well below that due to the weight of the machine.

Magic Effects on the Stage and Off

What the Mirror Does to You

By Alfred J. Lotka

IN the issue of December 24th, 1910, of SCIENTIFIC AMERICAN Mr. Herring propounded the problem: "Why does a mirror reverse right and left, but not up and down?" In an answer by Mr. Keen (January 28th, 1911) it was rightly pointed out that the cause of this inversion of printed or written characters (the example cited by Mr. Herring) lies in the manner of presenting the same to the mirror. It is the observer who turns the sheet about, and not the mirror.

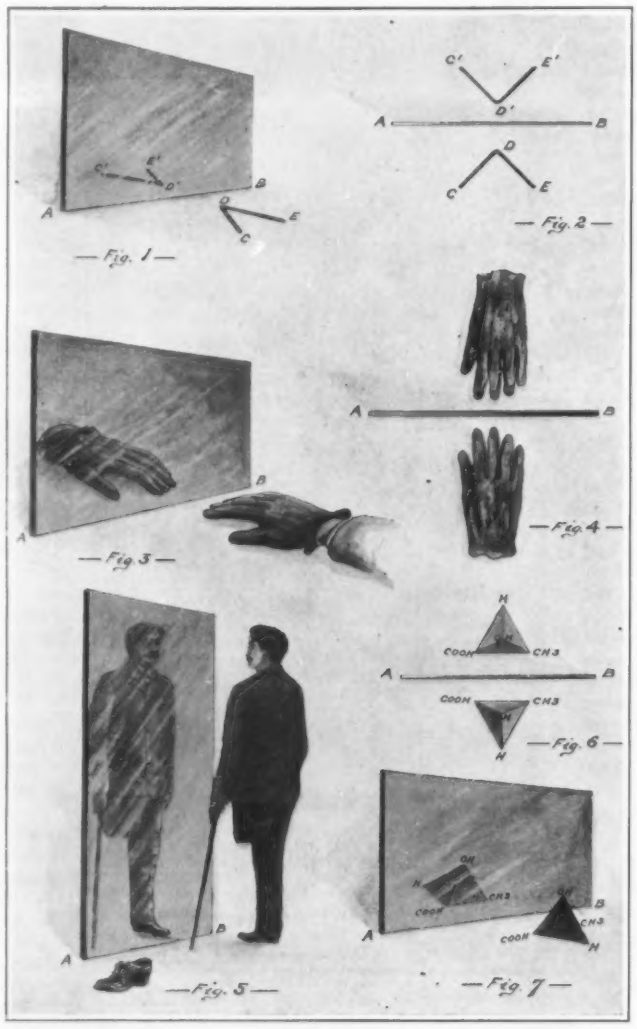
Now at first sight it may appear that this explanation completely settles the whole question, and that the image in the mirror is indeed a true and exact copy of the original. In point of fact this is not in general the case, although it is in a sense true of an object having only two dimensions, such as the plane surface of a sheet of paper, and the writing upon it. For this reason, in order to obtain a full understanding of what the mirror does, it is necessary to choose another object for our example, one which extends in the three dimensions of space.

Let us take first of all a simple case, which for our immediate purpose may be still two-dimensional, provided it does not lie in a plane parallel to that of the mirror. Suppose we present to the mirror a V-shaped object *CDE*, for example, a wire bent to the shape indicated (Figs. 1 and 2). To an observer in front of the mirror, the image of *CDE* will appear located at *C' D' E'*, as shown in perspective in Fig. 1 and in plan in Fig. 2. Note that the point *D* which lies farthest back in the original object, in the image is represented by the point *D'* lying farthest forward. Note also that *C' D' E'* may be produced from *CDE* by turning the latter *inside out*, and displacing it a certain distance backward. If this is not immediately obvious, imagine *CDE* to be made of flexible material, such as string. If the point *D* is held fast, and *C* and *E* are pulled forward through a certain distance, evidently a figure like *C' D' E'* is obtained. We may therefore say that what the mirror does to *CDE* is to *turn it inside out*.

Now, so long as the object is merely two-dimensional, as in the present example, there is little gained by this point of view. For we might with equal justice say that *CDE* has simply been rotated about *AB* through 180 degrees.

The matter assumes a very different aspect as soon as we turn to a three-dimensional example. Suppose a glove is lying on a table in front of the mirror *AB*, as indicated in our second illustration (Figs. 3 and 4). What will its image be? Suppose the glove was that which fits your right hand; the image will be such a glove as you would obtain by turning your right hand glove inside out—a left glove. Figs. 3 and 4 illustrate this case. If you are not convinced, try it. Suppose a one-legged man could be put through the operation which the mirror performs upon you. Should he have had the ill luck to take off his shoe before he underwent the change, so that the shoe retained its original character, he would now find that it no longer fitted his only foot! For if this was his right originally, it is now his left, and his shoe no longer fits it (Fig. 5). He might of course easily avoid this awkward predicament by wearing his shoe while being "turned inside out," in which case his shoe also would be converted into a left shoe. The perfectly symmetrical man would not be affected in any way, as regards

(Continued on page 197.)

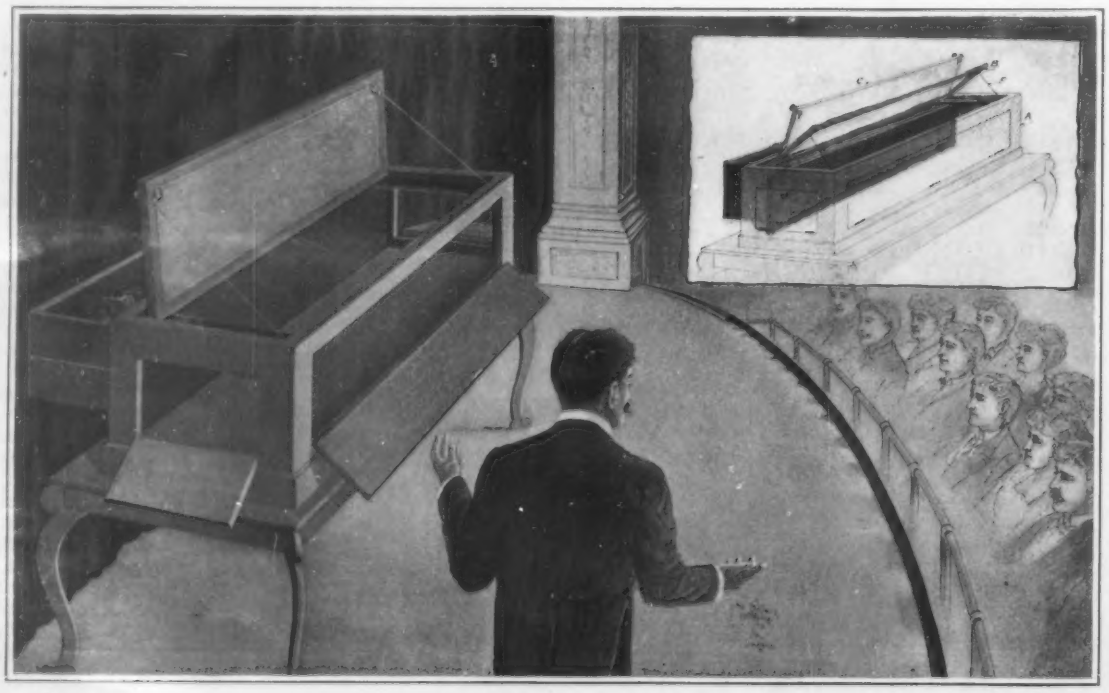


What the mirror does to a solid body is to turn its surface inside out.

A New "Vanishing Trick" Box

A FAVORITE trick both with the professional conjurer and the amateur is to cause the unaccountable appearance seemingly from nowhere of various objects or persons, and their equally mysterious disappearance. Various artifices and devices have been used, according to circumstances, to produce these enigmatic effects. Our illustration shows a new form of trick box, by the aid of which the conjurer may for example exhibit the remarkable manifestation of "the vanishing lady." The mechanism of the device is very simple. The box is provided with a drawer, which slides out backward, in the direction away from the audience, so that when withdrawn it is hidden from view, its front panel then forming the back wall of the box as seen by the audience, when the flaps in the sides of the box are opened for inspection. The conjurer starts by opening the lid at the top of the box. A system of cords (*IF*) and pulleys is so arranged that this action of lifting the cover at the same time causes the drawer, containing the vanishing lady, to retreat backward into the position shown in the body of the illustration. The cords may be made black, so that to the audience they are invisible. The flaps are opened, exposing the apparently empty box to view. To fully convince the audience, a rod may be passed through the box, showing that there is no deception. The flaps are then closed and the lid brought down. The conjurer makes a few passes over the box, addresses his audience with the usual kind of patter, and presently opens the box once more, this time tilting it forward, so that the audience can look right into it from the open lid. And there, right enough, appears the mysterious lady in the box. For on closing the lid the drawer has moved forward into the box under the action of springs. In making his passes the conjurer has loosened two catches, with the result that, on opening the lid for the second time, only the central portion *C* of the cover is raised, leaving behind (unknown to the audience) a narrow marginal frame (shown at *B* in the detail drawing). It is this frame to which are attached the cords actuating the sliding drawer. Hence on lifting only the main portion of the lid, without its marginal frame, the drawer is left within the box, and is exposed to view, with its contents, on tilting the box forward. There is, of course, now no difficulty in once more closing the chest, fastening the catches, and displaying once more an empty box upon opening the lid. Variations and embellishments can of course be added to this performance to increase the spectacular effect. But it may be left to the ingenuity of the reader to devise these for himself.

The apparatus here described was designed by Mr. R. B. Smith, an Australian inventor now resident in New York, and the accompanying drawing was prepared by the artist of the SCIENTIFIC AMERICAN from a small working model kindly lent by the inventor. Mr. Smith is identified with numerous inventions chiefly relating to clocks and illusion apparatus for theatrical use.



Conjurer's trick box for "Vanishing Lady" performance.

[The Editor of Handy Man's Workshop will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

Some Methods of Inserting Small Screws

IN Handy Man's Workshop of May 27th we described a simple device for holding small screws, while inserting them into the work with a screw-driver. A number of other suggestions for doing this work have since been received and are given below.

Here are three good ways for holding small screws, of either machine or wood type. A small piece of wire is bent double at one end, and slipped under the head of the screw. This serves to hold the screw steady, while the screw-driver is manipulated. After the screw has a firm hold, the wire is removed. A second way is to cut a small strip of tin to the shape shown in the accompanying sketch. This is a universal

Device for holding small screws.

tool, as it holds screws of different sizes. A third way is to take a strip of rather stiff paper and push the screw through it at one end. When the screw holds, the paper is torn away.—B. F. DASHIELL.

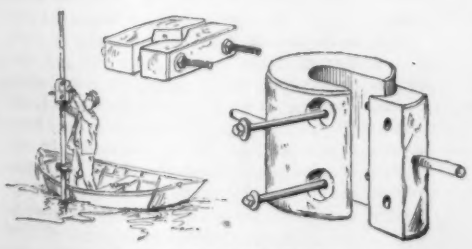
The following is a scheme that the writer has used for twenty years. Take a soft piece of wood and trim it to fit tightly into the slot in the head of the screw. Press the tapered point of this wooden screw-driver ino the slot, then insert the screw, screw it into the hole, and finally turn it home with a metal screw-driver. With this device, one can set a screw in the back of a spring clock, or other piece of machinery, where it is impossible to reach the spot with the hand, or with the tool illustrated in the issue of May 27th.—W. R. CRAWFORD.

To insert small iron or steel screws, a very simple and handy way is to rub the end of a small screw-driver over one pole of a horseshoe magnet. The end of the screw-driver will be readily magnetized, and will pick up and hold the small screws so that they can be inserted. Many of the small screws in clock and watch works are so tiny that a separate tool cannot be readily used without danger of dropping them into the movement.—JAMES E. NOBLE.

Methods of Driving and Pulling Stakes

By Albert F. Bishop

A GOOD hammer for driving mooring stakes may be made of an elm butt, nine or ten inches in diameter, and fourteen inches long. In the center a hole should be made, three inches in diameter. It can be sawed on a band saw by removing the saw

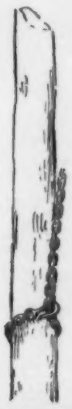


Hammer for driving stakes.

guide. This done, two parallel cuts should be made, three inches apart from the periphery to the hole, leaving a block which can afterward be replaced and secured to the body of the hammer by means of two five-inch bolts, as shown in the drawing. When tightly bolted, the result will be equivalent to a solid ring-shaped hammer. This should weigh about 35 pounds. Handles may be driven in at opposite sides of the hammer so as to permit of operating it readily. In use the block is unbolted and the hammer is placed on the stake, after which the block is replaced and bolted in place again. A collar is attached to the stake upon which the blows are struck. The collar may be made of curly hickory, or wood that will not split, after the pattern illustrated, with ⅝-inch bolts used for clamping it to the stake. The operation of the device is shown quite clearly in the drawing, and in order to prevent the collar from slipping, it would be advisable to use spurs on the V-shaped portions of the clamps, so that they will nip into the stake.

In pulling stakes the lever is commonly used, although a Spanish windlass can be operated by one person, and is very sure to perform the work satisfactorily. The windlass may be made of a round piece of hard wood about four inches in diameter, with holes bored near each end to receive the iron bars or levers with which it is turned. It should be rested on a couple of half boxes hollowed out to fit the four-inch barrel. These journal boxes should be greased and should be secured to pieces of scantling laid across two boats. To grasp the stake, a chain is

Raising a stake with a windlass.



The chain grip.

used. This should have a ring or hoop in one end. The chain is passed around the stake and slipped through the hoop, and then is given three turns about the windlass. When the chain is under tension it will grip sufficiently to raise the stake without slipping. When lowering the chain for a fresh grip on the stake, it will slide down easily if shaken slightly by the handles.

Handy Fly Killer

MY "Handy Man" made me such a fine "typhoid fly" killer, that I would like the wives of other "Handy Men" to have it. When renewing a window screen, there was a small piece of the wire screen left over; my husband took a piece about 4 inches wide

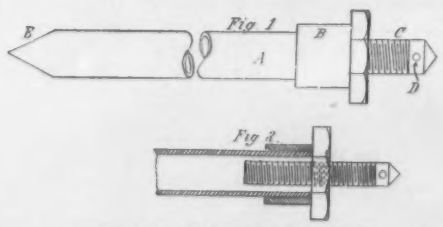
Fly killer made of wire netting.

and 12 inches long, doubled it, fastened the ends in a saw kerf, sawed in the end of a small stick about 14 inches long. This gave me a "weapon," with which I can easily kill intruding flies by a sharp, quick stroke; it is very effectual, indeed.—EDITH BADER.

A Planer Brace

AN excellent device for bracing work on a planer or boring mill is pictured herewith.

Fig. 1 shows the tool and the way it is assembled. The part marked *A* is a piece of 1¼-inch pipe flattened at *E*. *B* is a nut which fits over the pipe *A*. *C* is a



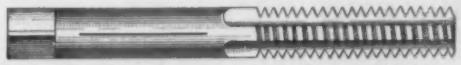
Device for bracing work on a planer.

piece of 1-inch round steel threaded and drilled at *D* for the purpose of adjusting its length. By having an assortment of lengths of pipe as shown at *A*, the nut *B* and rod *C* remain together and may be inserted into the pipe end at will.

Fig. 2 shows a sectional view.

How to Prevent Taps from Breaking

THE sketch reproduced herewith shows a handy kink in the way of preventing taps from breaking. It is very discouraging to try to tap out a small hole in a piece of work and have the tap break off in the hole. In most cases this means that you must have the broken part of the tap annealed before it can be drilled out. To avoid this difficulty cut a line parallel with the shank of the tap, as shown in the drawing. The tap is then heated, half way between the threads and shank end, to a light blue color. This



A tap that gives warning of undue strain.

will eliminate the breaking of the tap, as the shank will twist before it will break and the line will show that the shank of the tap is twisting, thus giving the user warning.

This has proved to be a very valuable little kink on small taps.

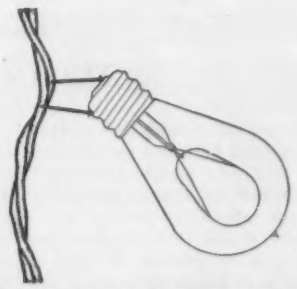
Locating a Break in an Electric Flatiron Cord

By Paul H. Woodruff

ELECTRIC cord of the kind furnished for connecting an electric flatiron with the supply, by way of a plug inserted in a lamp socket, is usually heavily insulated with a thick covering of rubber and a sleeve of coarse woven cotton. For this reason it is rather difficult, when the conductor becomes broken inside its covering, to locate the exact point of the break; because since the insulation is much stiffer than the stranded copper conductor itself, the ordinary bending test will not show the injury with any degree of certainty.

As an example, a household electric flatiron recently "went dead," and an examination showed that the heating elements and the terminals of the iron were all right. To all outward appearances and tests the cord was all right, too; but a lamp connected by a pair of short wires to its apparatus end failed to light up. As it was inexpedient to obtain a new cord at once, and the implement was needed immediately, the following simple test was resorted to:

The plug on the end of the cord being screwed into the supply socket, with the socket key turned to "off," two common brass pins were inserted into the double cord, one into each conductor. The pins were so placed that their points pierced the cotton and rubber



Locating a break with lamp and pins.

insulation and made contact with the stranded copper conductor within. The key switch was then turned on and an ordinary sixteen candle-power incandescent lamp, held in the hand, was pressed against the heads of the two pins in such a manner that one pin made contact with the metal sleeve of the lamp base, the other with the metal button in the center of the base. The lamp immediately lighted up, showing that the cord was intact from the plug to the point where the pins were inserted.

The current being turned off again, the pins were withdrawn, and replaced at a lower point in the cord—that is, nearer the apparatus end—and the lamp was pressed against them. This process was repeated at intervals of a few inches until a spot was found, within a few inches of the flatiron end, where the lamp did not light up. The pins were then moved back and forth until the exact spot was found where the current ceased to flow. The cord was then cut off at this point and one of its conductors found to be broken cleanly in two. It was an easy matter to strip the insulation from the newly-cut ends and refasten them in the flatiron connector plug, when the iron was found to be as good as ever.

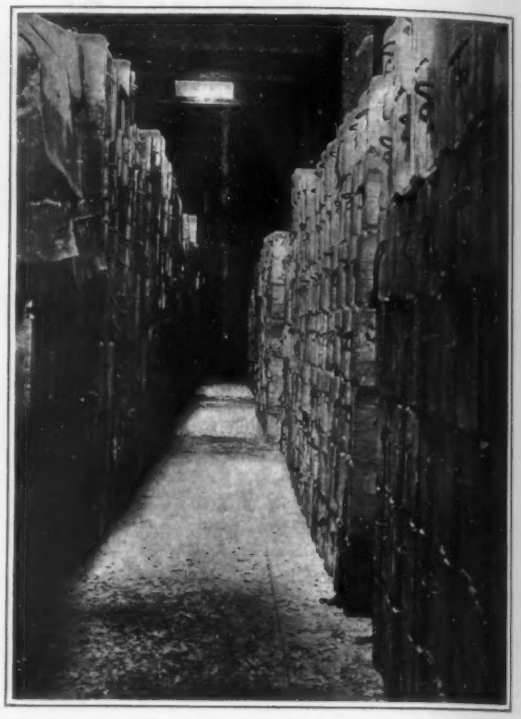
This is an extremely simple "kink," but, like many other simple things, might not occur to everyone who finds himself in the same predicament. The most important precaution to observe is to turn the current off before inserting or removing the pins. A shock in the fingers is not serious, but it is a trifle unpleasant, especially with alternating current at 110 volts.

Soldering Flux.—A good soldering flux for copper is a heavy paste of resin. This paste is made by dissolving as much resin in benzine as the benzine will take up. The paste is easily applied with a stiff brush.—H. D. CHAPMAN.

The Inventor's Department

Simple Patent Law: Patent Office News: Inventions New and Interesting

The Search Room of the Patent Office. An exhibition hall now utilized for the accommodation of patent attorneys, who examine the records of granted patents. All day this room is filled with attorneys and their assistants, who sometimes appear in such great numbers that they are forced to use the halls and other rooms for their work.



In the foreground is shown the tar which has dripped from the model-vault lights, to protect the boxes from which old carpets and tarpaulins have been spread.

The Need for a New Patent Office

The Overcrowded Conditions in an Obsolete Type of Building

THERE is one thing which the inventors of this country have not yet obtained and which they have a right to demand, and that is a new building for the United States Patent Office.

When it is stated that the inventors have the right to demand it, that is exactly what is meant, in spite of the fact that the small army of examiners and clerks who work day in and day out within the walls of the old Patent Office, in cramped and out-of-date surroundings, would be affected most materially and directly by the erection of a new and commodious building. The discomforts that these latter must bear, and the very obvious disadvantages under which they labor, are not nearly so far reaching or important as the fact that poor facilities for work retard work; and the fact that employees are laboring under conditions which ought not to exist and which would scarcely be tolerated in a well-ordered and up-to-date factory, leaves the inventor, who is the sole customer of the Patent Office, in the position of not having his work done with the dispatch and exactitude which he should expect from his dealings with the Government, and which might obtain were the force of workers not herded together in an old-fashioned and overcrowded building.

This statement may come as something of a surprise to the readers of this article. Most of the inventors have seen a picture of the Patent Office. That is to say, they have seen pictures of its outside. There is no intention to belittle the classic outlines and graceful proportions of the Patent Office structure, which as an architectural achievement leaves nothing to be desired. It is a handsome and solid building of white stone, and has the appearance of an old Greek temple, or if one does not care for romantic comparisons, it may be likened to the appearance of an art gallery or a museum.

But there are about one thousand people inside of this beautiful building who have something else to do besides contemplating its architectural grandeur. It is not surprising that some of them should wish for modern conveniences in place of classic excellence. A quarter of a century ago the working force of the Patent Office occupied but a small part of the building. Various Secretaries of the Interior have, however, from time to time, managed to get rid of the Land Office and the Indian Office and some other bureaus of Uncle Sam's largest department, and they have been housed elsewhere. At the present time only the personal staff of the Secretary of the Interior shares the building with the Patent Office. Secretary Ballinger, indeed, offered to move out of the quarters he occupied, if by so doing he could relieve the growing need of the Patent Office for more space. The few rooms, however, that the Secretary's force could relinquish would not permanently benefit the Patent Office. To tell the truth, it has outgrown its present quarters, and a new building has become a crying need.

One has only to enter the Patent Office and look about him to realize the weight of this statement. Like a boy who has long since outgrown his Sunday suit, but who is required by parental authority to continue to wear it, the Patent Office goes on expanding without room for expansion. The boy's arms hang far below the sleeves of his jacket, and his legs look ridiculously attenuated in the short, tight pants. It is unfair to the boy to make him the laughing stock of his companions. It is equally unfair to build costly modern buildings at public expense for other branches of the Government, and let the Patent Office, which is one of the few bureaus of the Government that is absolutely self-supporting, and which has an actual surplus of nearly seven millions of dollars, all of which has been paid in by the inventors of the country, go on occupying its old quarters, which, like the boy's suit, have bulged at the seams these many years.

Take, for example, the matter of the storage of records. Can anyone be so insensible to the value of the records of the inventions of the last century to claim that their careful preservation is not a matter of the gravest importance? Every conceivable inch of space in the Patent Office is now being used for the storage of valuable records, which if they should ever be destroyed, could never be replaced. The hallways are used for the shelving containing the copies of granted patents. These copies are being constantly called for, and must be kept right at hand, where they can be easily found at a moment's notice. Yet their orderly arrangement is impossible, when they must be put wherever there is available space. There are now over a million of patents which have been granted, and the office must keep on hand a sufficient supply of copies of these to satisfy daily and hourly demands for them.

Room must also be had for the convenient and safe filing of the original papers in each one of these patent cases. The drawings, too, must be carefully preserved, for together they constitute an actual, visible record of the achievements of the American people in the field of invention since the establishment of the patent system. Where in all of the different branches of the Government is there a more valuable collection of papers, or a more authentic and significant record of the progress man has made in the last one hundred years?

The Scientific Library of the Patent Office, with its priceless collection of publications on the subject of inventions, including copies of two million foreign patents, occupies a small section of a corridor, and the books are inconveniently disposed in a very restricted portion of the galleries which were originally intended for the display of models. The value of the library is almost beyond estimate, as many of the publications in the collection could not be replaced. In the old-fashioned building, which is not fire-proof or modern, they are exposed constantly to the danger of destruction by fire. The warning furnished by two previous fires of a disastrous nature in the Patent Office, has passed unheeded. The Assignment Division, which is one of the largest in the Office, occupies a corridor, also intended at one time for the model exhibit. In it are kept the records of the titles to inventions. The deeds showing these titles are as important, if not more so, as any collection of deeds to real property, and their destruction would be a calamity so far reaching as to touch the rights of nearly all the leading manufacturers and merchants of the United States. In this division the desks of the clerks are packed closely together, none of the clerks get the number of cubic feet of air prescribed by the rules of hygiene, and some of them work all day under artificial light. The galleries are filled with the copies of patents, which now overrun the entire building.

Many of the examining divisions occupy cramped and badly lighted rooms. Each division is forced to keep its own files of pending applications, and from five to eight persons are the rule in each room, and more are frequently found. Even the basement of the building has been partially remodeled, so that some of the store rooms could be utilized for the use of the working force.

When it is remembered that dust, rats, and mice, to say nothing of possible conflagrations, create irreparable damages in a comparatively short time, the proper housing of the Patent Office becomes a

question of national interest. Every inventor and manufacturer of the nation may be said to suffer from the danger that would arise from the destruction of some important paper, the bearing of which on a future invention might be of the utmost importance.

The same is true of the Patent Office models. Upon an improper understanding of the matter, Congress has during the last few years made many attempts to dispose of these models by sale, gift, or otherwise. When they were crowded out of the Patent Office, they were placed on exhibition in a building adjacent to the Office in expensive glass cases, so that they might not only be accessible as a part of the official records in frequent use by the Office and for use as evidence in suits in the United States courts, but that they might also furnish a very interesting and instructive exhibit to the general public. It was customary for excursions from colleges and schools to visit Washington mainly for the purpose of studying this exhibition of historical objects, which showed the development of the mechanical arts.

Subsequently Congress omitted to appropriate money for the rental of these exhibition halls, and the models were placed in storage. The cases were sold and the models nailed up in wooden boxes, labeled, and given over to perfect oblivion, so far as the public is concerned.

Eventually Congress was convinced that it would be a mistake to dispose of these models, owing to the fact that they are still used in the courts as evidence in important cases, where vast sums of money have been saved in litigation on account of the irrefutable testimony given by these inanimate but eloquent witnesses.

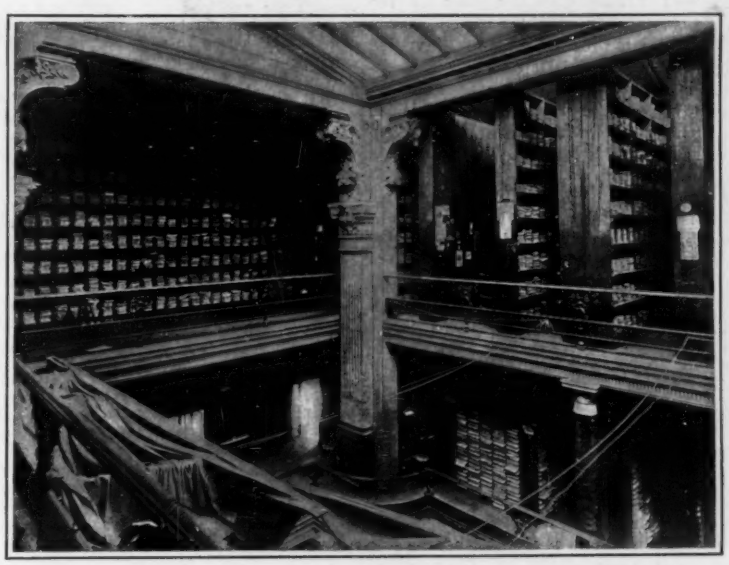
The high state of perfection reached by mechanical drawing now renders the construction of a model to accompany applications for patent unnecessary. Previously to the early '80's the drawings submitted did not always disclose clearly the real invention, owing to poor mechanical drawing, and models were absolutely essential. It is evident, therefore, that the present collection of models is the only real proof, actual and existing, of numerous inventions, and each and every one is liable to be called for and relied upon as evidence in the courts to-day.

The framers of the Constitution of the United States recognized particularly the necessity for encouraging the development of two faculties of the human mind in order that the young republic might speedily take her place in the front rank of the nations of the world. These faculties, thus recognized and encouraged, were those of literature and invention. Accordingly there was embodied in the Constitution that provision that Congress should have the power to promote the progress of science and the useful arts, by securing for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries. Under this wise provision the present patent and copyright laws have been enacted by Congress.

The Library of Congress, one of the world's most beautiful structures, is proof enough that the artists of the nation, the authors, the musicians, have not knocked in vain at the door of Congress that their works might be preserved to posterity forever. The new National Museum too provides ample room for the display and preservation of records of the past, pertaining to archeology, zoology, anthropology, geology, and history. The implements of war and peace presumably used by prehistoric races are spread out before the public and are available for research by the student. The whole history of man may be studied and contemplated by whosoever will.

On the other hand, the Patent Office models, the actual embodiments of the first inventions of our many arts and sciences, are allowed to lie—more than one hundred and fifty thousand in number—stored in wooden boxes in the cellar of the office building of the House of Representatives. Not that they are wanted there! But Congress would not appropriate money for their proper keeping, and there is no longer any room for them in the old Patent Office building. They had to be sheltered somewhere, and a few vaults happened to be empty in the new House office building, so consent was given to store them there.

Portion of the corridor, 20 by 40 feet, in which twenty-two persons operate typewriters; the ceiling is 8 feet 3 inches from the floor.



Storage place for copies of patents in space originally intended as an exhibition hall for Patent Office models. All the available room in the halls of the building is thus occupied by copies of patents.

In this room in the Patent Office, divided by a temporary partition, twenty-four persons work all day under artificial light. The windows look into the north portico and no sunlight ever comes into the room.

The Scientific Library, where ninety thousand books are stored. The space is so restricted that perfect classification is difficult, and access to the books is not always immediately possible.

The mere fact that models are not longer required by law to be filed by the inventor with his application for patent. does not render those that have been so offered and accepted in the past any less valuable as records and evidence. In fact, their value as exhibiting what has been done in the past in nearly all known arts increases rather than diminishes as time goes on.

When the Patent Laws were revised in 1870, the following provision was inserted in the Revised Statutes:

"484. The Commissioner of Patents shall cause to be classified and arranged in suitable cases, in the rooms and galleries provided for that purpose, the models, specimens of composition, fabrics, manufactures, works of art, and designs, which have been or shall be deposited in the Patent Office; and the rooms and galleries shall be kept open during suitable hours for public inspection."

In spite of this mandate of the law, inventors and manufacturers, visitors and tourists now inquire in vain at the Patent Office for the rooms where the models are displayed. They are surprised to hear that they are stored in almost inaccessible cellars.

It is difficult to reconcile this history of the Patent Office models with the beneficent government which provides palatial buildings for nearly every branch of the service, and erects stately museums and libraries. This anomaly could easily be overcome by the erection of a new and suitable building for the Patent Office, and it should speedily become the business of every citizen—for every citizen benefits by the patent system of the United States—to advocate the construction of such a building.

As pointed out in the early part of this article, the Patent Office has an absolutely net surplus in the United States Treasury of nearly seven millions of dollars. Every dollar of this has been paid in by the inventors of the country. The sum is more than sufficient to build an adequate and modern building for the Patent Office. Congress has only to give the necessary authority; it does not have to appropriate a single dollar out of the revenues of the Government. The money is there; the Patent Office has earned it; the inventors have paid it in. There ought to be a building wherein the records of inventions could be safely and conveniently kept, beyond all danger of destruction. There ought to be well-lighted and properly ventilated accommodations for the examiners and clerks who perform the difficult and important work of determining whether an invention is new or old. Moreover, inventors have the right to demand that the facilities be furnished whereby their applications for patent can receive the highest possible degree of care and accuracy in examination.

It is not likely that this neglect on the part of Congress to provide for the Patent Office has been deliberate, but it arises from the fact that most of the members of Congress are not in possession of the facts regarding the needs of the Office. What is required now is a campaign of publicity, a system whereby not only Congress, but the people everywhere, may realize that the inventors of the nation are paying for something to which they are justly entitled in the Constitution, but which they do not always get.

Without great commercial resources and activity a nation cannot become great. The inventors and the manufacturers, the buyers and the sellers furnish the sinews of the country, and upon invention and invention alone has commerce been founded. Invention, instead of lessening the number of distinctive kinds of employment, has been shown by actual experience to have increased them.

The late Senator Daniel of Virginia, who was an enthusiastic worker for the inventors, is the author of a bill which expired with the last Congress, but which provided for and specified the particular location upon which the Greater Patent Office should stand. This site is immediately north of the Library of Congress, facing the east front of the Capitol.

It is inevitable that this site must ultimately be occupied by a Government building; and since the Patent Office is the twin sister of the Library of Congress, considering its protection of the products of the human brain, there is no doubt that it should be so located. The present Commissioner of Patents has repeatedly urged in his reports, and orally, to Congress the necessity for improved and modern quarters for carrying on the work of this important bureau. Every month that passes deepens the gravity of the present situation, and since it will take years to erect such a building as will be required, the action should be taken by Congress at the earliest possible moment.

Notes for Inventors

Liming Apparatus Needed.—In many localities the soil is limed at intervals and it is very common to see piles of lime spaced apart throughout the fields. The former practice in liming the soil was to apply large amounts (1 to 3 tons per acre) at long intervals. Investigation has shown, however, that, as a rule, it is better practice to apply smaller amounts (500 to 1,000 pounds per acre) at shorter intervals. One difficulty in the way of a general adoption of the latter practice has been the lack of an implement that will evenly distribute such small applications of lime. It ought not to be difficult to devise such a distributing machine, and there is no doubt that an efficient implement for this purpose would aid greatly in promoting a desirable agricultural practice.

A New Form of Package.—The wrapping of merchandise, particularly proprietary articles, whether they be medicines or breakfast foods, has received much thought and great advances have been made. There appears, however, to be a field for improvement in a wrapper which will serve its purpose as a distinctive, attractive label for the package until it has been sold at retail to the consumer and can then be utilized to wrap the package for the customer in the usual way. This might be effected in various ways, such, for instance, as by breaking a seal on the label wrapper and reversing the latter to bring its plain side into position to form the outer cover of the package. Such a wrapper should be popular with the retailer, the field of usefulness is practically unlimited and a satisfactory solution of the problem will doubtless require the careful consideration of an ingenious inventor.

Fishing by Machine.—Just think of a man out fishing and wanting mechanical help in catching the fish! This is provided by Wladyslaw Filipowski of Hawthorne, Ill., in a patent, No. 999,214, for a fishing device which may be screwed into a post, pile or other support and has a spring arm over which the line is guided and a trigger to which the line is connected so that tension on the line, as when a fish bites, will pull the trigger and release the spring arm so it can pull upon the line.

New Baseballs.—Two baseball patents, Nos. 999,526 and 999,527, have been secured by Benjamin F. Shibe of Bala, Pa. One of the patents shows a ball with a rigid, inflexible central core and layers of thread wound upon it, and the other a layer of highly resilient material between the inflexible core and the layers of thread. In the description accompanying patent No. 999,526 the patentee states that heretofore baseballs have been constructed with the filamentous windings on a central core or foundation of a resilient, yielding substance such as rubber, upon the theory that the "reboundancy" of the structure was derived from the action of the resilient quality of the central core, but he has found that the use of a resilient core is unnecessary to produce resiliency in the ball, but that by the use of a rigid, unyielding and inflexible center core the reaction of the resilient qualities of the windings from a blow is more prompt and of greater effect and that the ball responds or rebounds with greater resiliency from the bat than if the core were more resilient and less resistant. When it is considered that probably more than twenty-five thousand baseballs are made every working day in the year, the importance of improvements in this line becomes evident.

A Bow Separator for Motor Cars.—The Packard Motor Car Company is the assignee of a patent, No. 994,852, for a bow separator for vehicle tops, invented by Allen Loomis of Detroit. The separator is especially for use on automobiles, and the machine has a rest on which is supported the lower long bow of the top when the top is lowered. The separator is to hold the bows apart so they will not rub against one another. Thus the separator is supported on the lower long bow and it has recesses which receive the intermediate bows, and also supports the upper long bow. Thus all the bows can be secured together and be supported on the vehicle and the weight of the top bow will not be exerted on the intermediate bows and the bows will not rub against one another.

Melting of Snow.—Samuel Friedman of New York city has patented No. 999,445, a snow melting machine, and a method of converting snow into slush, the latter consisting in imparting heat to the snow and also adding salt to prevent the formation of caked masses of snow. The machine has a tank and a chute through which the snow is conveyed to the tank, and a spring-supported plow, which can yield to pass obstructions.

Legal Notes

Classification of German Patents.—The United States Patent Office has for sale a translation of the Manual of Classification of the German Patent Office. This translation and the numerical list of German patents, classified according to classes, sub-classes and groups, accessible in the Scientific Library of the United States Patent Office, will greatly facilitate the searches in the German patents.

Applying to a Court for a Patent.—In sustaining a demurrer and dismissing the bill in the case of Westinghouse Electric & Manufacturing Company v. Ohio Brass Company, 169, O. G. page 204, the United States Circuit Court for the District of New Jersey held that the remedy by bill in equity to obtain a patent which has been refused by the Patent Office, is a part of the application for patent and the failure of the complainants to institute proceedings within one year after the last official action on their application, to wit, the adverse decision of the Court of Appeals of the District of Columbia, is a bar to such proceedings by bill in equity.

Ex Parte Harris.—In affirming the decision of the Commissioner of Patents, in the case of ex parte Harris, the Court of Appeals of the District of Columbia has decided that claims, for a method of preparing beverages, which include the three steps of preparing, storing and dispensing the beverages, cover mere aggregations, since each of these steps is complete in itself and independent of the others. The method involved was for preparing beverages such as tea or coffee, in which a current of boiling liquid was admitted within a charge of material, the resulting infusion was heated to a steaming condition, and the infusion so produced was stored under the pressure of the steam evolved therefrom and free from contact with the charge.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

BARRETTE.—A. SCHÄRER, New York, N. Y. The objects of this invention are to provide a barrette which, when once placed in the hair, will be securely locked in position by gripping the strands of hair, and thus keeping the stray locks in place, and avoiding danger of displacement or loss; to provide a barrette which will be simple of construction, ornamental and readily attached and detached.

Of Interest to Farmers.

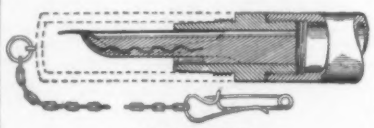
INCUBATOR.—G. H. LEE, Omaha, Neb. Among the principal objects the invention has in view are: To provide means for ventilating an incubator wherein the ventilation is diffused, preventing the formation of drafts and avoiding the necessity of forcing air through the machine; and to provide a simple, efficient and durable construction whereby the ventilation may be varied.

THRESHING MACHINE.—C. M. FRICK, Township 23, Pawnee County, Kan. This invention provides a feeding conveyer which may be thrown in one position so as to feed the material to the threshing part of the machine, or may be shifted to another position, in which it feeds the material over the end of the machine onto the ground. Another feature is a screen for sifting grain from chaff, which will be automatically maintained in a substantially horizontal position irrespective of whether the machine is going up or down hill.

Of General Interest.

METHOD OF REMOVING NICOTIN FROM TOBACCO.—J. SARTIG, Nikolassee, near Berlin, Germany. This method treats tobacco or tobacco products in closed vessels, where the air is rarefied, with low pressure steam at any temperature below 100 deg. C., while simultaneously preventing every condensation of the steam in the tobacco by heating the closed vessels from without by surrounding liquid, and in conducting the volatilized nicotin with the steam carrying it away to devices of any known construction for recovering the nicotin.

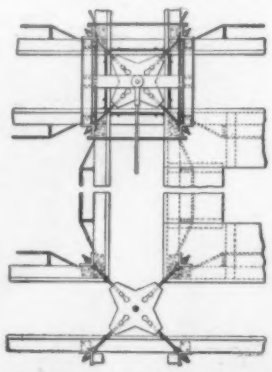
FOUNTAIN PEN.—W. A. HOUSTON, Tracy Pen Co., Tracy, Minn. This device insures a uniform flow of ink to the pen nibs and paper, and its simple construction affords means for preventing the dropping of ink from the feeder or pen point to the paper in case the ink is fed too freely at times,



FOUNTAIN PEN

whereby the surplus ink supplied is effectively taken up and retained until required, the writing rendered uniform and regular, and blotting, caused by the dropping of ink from the pen point, is avoided. The overflow reservoir is so constructed that a relatively large amount of surplus ink may be confined within a small space at the end of the feeding device. The device illustrated herewith is a sectional view taken axially through the nozzle portion of the pen provided with the feeding device, and showing part of the end of the ink reservoir.

MOLD FOR CONCRETE STRUCTURES.—J. S. LINTON, 1530 South Central Park Avenue, Chicago, Ill. The illustration in this case shows a mold or form for making concrete structures, such as walls, columns, beams, etc., and arranged to securely hold the mold parts in position, to allow of raising the mold as the building of the structure progresses, and to temporarily support the concrete material to be used in the formation of the structure.



MOLD FOR CONCRETE STRUCTURES

The special means for raising the mold are shown and described in the application for Letters Patent of the U. S., No. 953,476, granted to Mr. Linton. The mold is provided with sets of uprights having brackets for supporting horizontal beams extending from one set of uprights to the other and to which the mold sides are secured so that the concrete material can be readily filled into the space between the opposite mold sides.

Hardware and Tools.

RAZOR STROPPING DEVICE.—MILLARD F. COONS, 414 Broadway, New York, N. Y. The invention has for its purpose the provision of a device with two arms articulated together, one of the arms being pivoted to the frame in which the stropping member is secured, a razor blade being mounted on the other arm. The perspective view of this durable strop shown in the engraving represents the device in use. While it is not necessary to be used a honing strop can be readily applied to

RAZOR STROPPING DEVICE

the device. The device is simple in construction and easily operated when placed in the palm of the hand. The blades can be sharpened with great rapidity, and an easy free and clean swing of the blades may be obtained against the strop member. The complete outfit weighs three ounces. This improvement is Patent No. 1,000,237, issued August 8, 1911, and is to be commercially known as the "Millard Simplicity Stropper."

Heating and Lighting.

FURNACE.—W. SCHEFFLER, Gulfport, Miss. In this patent the invention has reference to furnaces for melting brass, and for other purposes, and has reference more particularly to a furnace in which is provided a movable support for a crucible or the like, together with means for moving the support into and out of the furnace.

Household Utilities.

KITCHENETTE STOVE.—E. S. ALLEN, New York, N. Y. The inventor mounts a kitchenette stove upon journals or bearings and provides it with gas from a gas pipe section, this gas pipe section being provided with a valve fitting into a stationary fixture to which gas is supplied; the arrangement being such that when the stove is tilted into either of its two positions the gas is turned on or off by the action of the valve.

Machines and Mechanical Devices.

ADDING MACHINE.—C. B. COREL, New York, N. Y. In this patent use is made of connected number wheels, a spindle and a stop bar ranging across the wheels, the said wheels and spindle being mounted to turn loosely one on the other, each wheel having its periphery provided with consecutive numerals alternating with recesses for engagement by a pencil in the hand of the operator, to govern the relative movement of the adjacent wheel and spindle, the stop bar turning with the spindle and forming a stop for the pencil or tool.

SPINDLE LOCK.—MATTHEW OMALIA, care Reynolds Brothers, 128 Coal Exchange Building, Scranton, Pa. The engraving illustrating this lock gives a view partly in elevation and partly in section, showing the lock complete. The more particular purpose of the invention is to provide an improved lock for preventing the removal of a spindle, such, for instance, as is commonly employed in factory work,

SPINDLE LOCK

from its mounting, yet allowing the spindle all the freedom of motion which it now has, and also permitting the removal of the spindle when the operator wishes to release the lock. Means provide for mounting the latch in position and there is a special provision for supporting the latch by aid of a rivet; and after the latter has been used means provide for the rivet being headed up the second time.

LEGAL NOTICES

PATENTS

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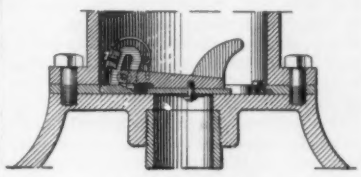
PUMP VALVE.—ERNEST D. ORTON, Farmersville, N. Y. The engraving in this case represents a vertical section of a valve for suction pumps, and one readily accessible for the purpose of cleaning or repairing. An object of the invention is the provision of a



PUMP VALVE

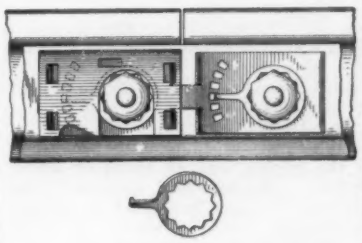
valve with means for adjusting the tension of said valve, for elevating water at different heights. Further, to provide a valve with means for lifting the same by direct downward contact, to release the water imprisoned above the valve. The valve may be adjusted to any pump already in use by cutting out the old valve and lowering into its place this improved valve, which is readily secured in position by means of lugs.

Prime Movers and Their Accessories.

ROTARY ENGINE.—T. IDZAL, Camden, N. J. An object here is to provide a novel form of engine in which a single rotary piston is acted on at several points in its rotation by the admission of fresh air. Means are provided for operating the abutment valves, so as to insure the greatest economy in the workings of the engine. Means provide for controlling the exhaust ports. The inventor accomplishes this by a series of valves whose position may be simultaneously adjusted by the manipulation of a single lever. A further object is to provide means for regulating the steam inlet.

Railways and Their Accessories.

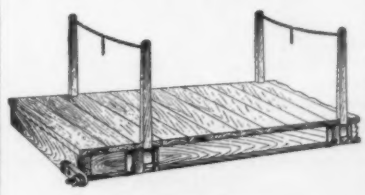
NUT LOCK.—CLAUDE B. STILLWELL, P. O. Box 522, Savannah, Ga. This invention relates to nut locks, and is particularly applicable to the construction of such devices when used in securing the nuts of the bolts which attach the fish plates to the rails at the rail joints. It constitutes an improvement on the device No. 880,930 patented by Mr. Still-



NUT LOCK

well. In the present case, the invention contemplates the use of improved means for preventing the nut from rotating on the bolt, and the principal object of the invention is to provide means for covering the mechanism of the device so as to prevent it from being injured or displaced. The illustration in the larger figure represents a side elevation of a railroad rail joint showing a modified form of the invention; and the smaller is a perspective view of a modified form of the lock plate.

CAR STAKE POCKET.—CHARLES FLINK, Ironwood, Mich. This invention refers to load-retaining means for vehicles, and especially to means whereby side stakes are positioned upon platform and logging cars, and which may be held in vertical position against



CAR STAKE POCKET

the pressure of a load, or may be easily released from a position of safety. A further object is to provide a stake pocket capable of disengaging the stake quickly without time being lost in cutting off the stake close to the pocket, and the consequent removal of the short piece therefrom; and has for a further object the provision of means whereby any form of stake may be used, or in which a particular shaped set of stakes may be carried. The illustration shows the device applied to a car platform.

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12522) H. L. W. asks: What causes the changes of a barometer at a given point? A. The changes of the barometer at any given place are caused by the change in the pressure of the air above that place. The atmosphere has waves in it of greater and less pressure, and these waves move around the earth, following each other much as water waves chase each other over the ocean. A high follows a low, and a low follows a high. A low barometer has been traced for about five weeks from the coast of Asia across the Pacific, Americs, the Atlantic, Europe, and into Siberia. While there are erratic changes there is also a general flow of areas of greater and of less pressure to which the barometer responds.

(12523) A. E. H. asks: Some months ago you published in your Answers to Correspondents an explanation to show that if an object sinks at the surface of water, it will sink to the bottom, no matter how deep the water may be; the greater pressure at increasing depth having no effect to keep the object suspended. I inclose 10 cents in currency and postage. Will you kindly send me a copy of your paper containing that statement? Or, if you prefer, republish your answer in an early issue, where I shall see it, as I buy the SCIENTIFIC AMERICAN regularly. A. The question of sinking or floating is determined by a law known as the Principle of Archimedes. It is that an immersed body is buoyed up by a force equal to the weight of the fluid displaced. If a body under water weighs less than the water it displaces it will rise; if it weighs the same as the water it displaces it will remain where it is; if it weighs more than the water it displaces it will sink. And if it begins to sink and no change is made in it, it will continue to sink, because it is more compressible than water. If it is heavier than water at one level, still more will it be heavier than the water at a lower level, since in going to the lower level it has been compressed by the water more than the water itself has been. Our attention has lately been called to the case of the submarine, which can be held at a selected depth. But the volume and the weight of the submarine are changed by admitting or removing water to adapt it to its desired depth, and it is made to have just the weight proper for the level it is to maintain. If it should begin to sink and no change were made in it, it would continue to sink to the bottom. It is no exception to the general case. The expression you use, "the greater pressure at increasing depth having no effect to keep the body suspended," is not quite correct. It has an effect, but not enough effect. To put it in another way, the sinking body becomes denser more rapidly than the water does at increased depths, and so must continue to sink. This is one of the questions of frequent recurrence. We recently gave the coefficient of compressibility of steel, one of the hardest metals and least compressible. It will be found in Vol. 124, No. 125, to which we refer for further statement.

(12524) J. S. J. says: I am installing an electric bell circuit with three bells and four cells attached. Will you please tell me in your Notes and Queries lines which is the most desirable—to connect cells in series, in multiple, or in series multiple? A. Probably four cells in series will be sufficient to ring three bells, though only a trial can determine that matter. If it is not sufficient, add more cells. The usual mode of arranging a bell battery is in series. When a sufficient number of cells have been put in series to give the voltage for the bells, you can get the necessary amperes by a second series of the same number of cells in multiple. A multiple arrangement of single cells is not desirable.

(12525) E. P. W. asks: If a locomotive drawing ten passenger cars running at a rate of speed of 40 miles an hour, should have every wheel of the locomotive and of each car securely locked at the same moment, would the momentum of the train stop at the same time? And what would be the probable effect on the train by the locking of each of the wheels at the same moment? A. If the wheels were locked by the brakes so that they ceased to revolve, the train would slide on the wheel rims until its momentum was exhausted. If you mean, however, that the wheels are to be locked to the track suddenly, we can only say that neither wheels nor car bodies, nor any other moving particle, can ever be *instantly* stopped except by *infinite* force, that is, by a force greater than any known quantity. No moving train could have its momentum instantly taken away; the attempt to do so has destroyed much rolling stock in railroad wrecks.

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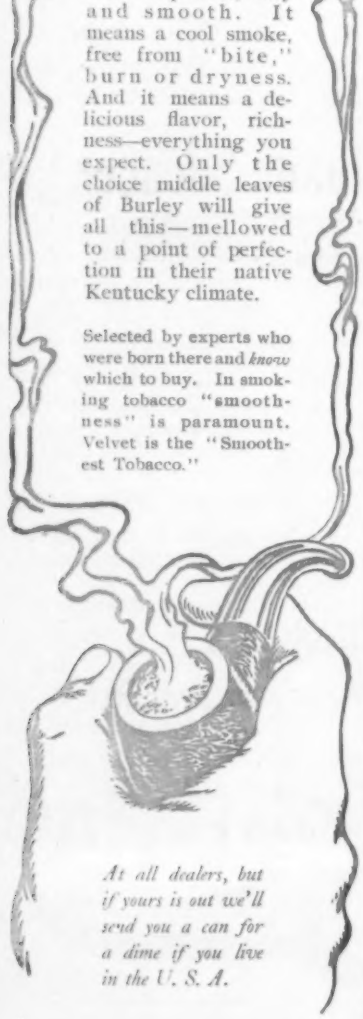

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Convert Abandoned Mills into Electric Power Plants

(Continued from page 184.)

wires at a high voltage over an extended area there is little difference from a point of view of risk to life between one high voltage and another. Only the best of construction should be used and proper provision for safety must be observed. This is not always the case with distribution systems having a voltage of about 2,000, and for that reason a voltage of 10,000 volts has an added advantage.

With a co-operative system the farmer can erect much of the line work himself, thus accomplishing a saving. Poles may be prepared in the winter time when work is not heavy. In some of the newer transmission installations, concrete poles are used with success and improvement in appearance. They are about 35 feet high, tapering from 15 inches in diameter at the base to 6 inches at the top, reinforced throughout with steel rods. Such poles can be made at home at any convenient time of year.

With a high voltage system and proper line construction the poles ought to be spaced not less than 200 feet apart and should take the most direct route from the source of electric supply to the point at which current is to be used. The immediate land over which the line passes should be assigned as a permanent right of way, proper provision for legally doing this and protection from malicious or meddlesome persons being made.

The cost outlay in constructing such a distribution system would be found remarkably small if the farmer should make and haul all poles and cross arms and supply the rough labor for setting poles and stringing wires. The actual expenditures would, therefore, be only in purchasing wire, insulators, guys, etc., that could not be had on the ground. The number and size of transformers and meters would vary according to the individual demand and local conditions. These, however, each one should buy himself in the same manner that he would electric motors and lamps. With such a system, all purchasing should be taken care of co-operatively, thus insuring to the individuals the benefit of quantity prices. In conjunction with the power plant a creamery, laundry and grist mill could be equipped and operated at very little extra expense, as the buildings and power available would prove ample for this.

The total cost of the undertaking, as here outlined, including power plant and line construction, would be in the neighborhood of $30,000, to be borne by twelve subscribers, thus each must contribute the equivalent of $2,500 cash. Certainly a successful farmer having upward of 300 acres should be able to muster this amount, if the investment will result in economy and safety.

The cost of operating a water power plant is naturally small, and it consists merely of the interest and depreciation charges, and the salary of one or possibly two men in attendance. If the plant is to give day and night service, then two men will be required, otherwise one is all that is necessary. The farmers' need for lighting during the early hours of the morning and the convenience of having current for this purpose at any time of night or day makes it a better equipment to have two men available for duty. The total salaries on this basis would approximate $2,000 per annum, and with 5 per cent interest and a like amount to cover depreciation and maintenance of the entire equipment, we have a total yearly cost of $5,000.

In regard to the amount of electricity that each farmer would be likely to use with a total equipment averaging in capacity the equivalent of 50 electrical horse-power, we are safe in assuming a load factor of five to ten per cent for eight hours per day.

Taking the lower figure, this represents 20 horse-power hours per day for each of the twelve farmers, for which a rate of 10 cents per electrical horse-power hour would be a proper charge for the subscribers to pay for their service. This would, therefore, provide a minimum yearly income of $6,000, assuming that this average amount of electricity is consumed for 200 days each year. Hence, on the basis of this somewhat over-conservative estimate, there would be sufficient yearly return to pay the cost of full operation and insure a 20 per cent margin for profit. The plant discussed is of sufficient capacity to take care of the maximum demands of all the subscribers at any one time, and as two power units would be installed of equal size, either one would have capacity for the average demands.

This outline of a real practical opportunity for farm betterment is only typical of several that the writers themselves have observed, and, doubtless, there are hundreds of small water falls of this character available if we but look for them.

To be sure it is hardly to be expected that the farmer as such is going to unravel the mysteries or details of a problem of this kind alone, but we shall expect his interest and foresight in recognizing the merit of such a scheme, and, once finding out its practicability, mastering the situation by so organizing that it may be successfully carried out.

The manufacturer finds capital and skilled assistants to convert his new ideas into practical commercial form, and the farmer to be successful must follow the same course.

Stress in Aeroplanes in Curvilinear and Fancy Flight

(Continued from page 189.)

frolic and fantastic flying.

In order to obtain actual data for the fluctuations of stress in an aeroplane in varied flight, I would suggest that a record be taken of the stress or strain of some tension or compression member of the machine in action; or simpler still, perhaps, that a record of the aeroplane's acceleration be taken, and more particularly its transverse acceleration. A very simple device to reveal the transverse acceleration of the aeroplane in flight would be a massive index elastically supported. A lath or flat bar stretching lengthwise of the machine, one end fixed, the other free to vibrate, and carrying a pencil along a vertical chronograph drum would serve such purpose. The whole could be incased from the wind as shown in the sketch. (Fig. 2.)

An adjustable sliding weight could be set to increase or diminish the amplitude of the tracing, and an aerial or liquid damper could be added to smooth the tracing. The zero line would be midway between the tracings made on the drum by the stationary instrument when resting alternately in its normal position and upside down; the distance from this zero line to the actual tracing of the stationary instrument would be proportional to the aeroplane stresses in level rectilinear flight; while in level flight on a curve,

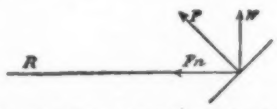

Fig. 4.—Resultant force due to horizontal wheeling.

either horizontal or vertical, the deviation of the mean tracing from the zero line would indicate the actual stress in the machine during such accelerated flight. Of course the drum could be omitted and a simple scale put in its place, so that the pilot could observe the mean excursion of the pencil or pointer from instant to instant. Also, the damping of such excursion could be adjusted to any amount in the proposed instrument, if the vibrating lath fitted its incasing box closely, with an adjustable passage for the air as it moved to and fro, or if light damping wings were added to the lath, or flat pencil bar.

Another method would be to obtain by instantaneous photography the position of the centroid of the aeroplane at a number of successive instants, from which could be determined its speed and path, or V and R of the first equation, by which data therefore the stress could be read from the first table.

Perhaps the simplest plan would be to add an acceleration penholder, with its spring and damper, to any recording drum the aeroplane may carry for recording the air pressure, temperature, speed, etc. Indeed, all such records could be taken on a single drum.

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A score of devices, more or less simple, but suitable for revealing the varying stress in an aeroplane, will occur to any engineer who may give the subject his attention, and it is desirable that some one obtain roughly accurate data for the stresses developed in actual flight. This is desirable in the interest both of aeroplane design and of prudent manipulation.

It is commonly supposed by aviators that the increment of speed due to diving is very prodigious. An easy formula will determine the major limit of such speed increment. If the initial and natural speed of the aeroplane be v, and the change of level in diving be h, while the speed at the end of the dive is V, the minimum change of level necessary to acquire any increment of speed V-v, may be found from the equation

$$h = (V\text{-}v)/2g$$

And if, as before, g be taken as 22 miles per hour, the equation reduces to the convenient formula

$$h = (V\text{-}v)/30$$

in which V and v are taken in miles per hour. Assuming various values for V and v, the following table has been found for the corresponding values of h in feet.

Minimum Change of Level Necessary to Produce Various Speed Increments.

Net Speed of the Aeroplane.	Increments of Speed, V-v.		
	Miles Hour 10.	Miles Hour 20.	Miles Hour 30.
M. H.	Ft.	Ft.	Ft.
30	23.3	53.3	90.0
40	30.0	66.7	110.0
50	36.7	80.0	130.0
60	43.3	93.3	150.0
70	50.0	106.7	170.0

For example, if the natural speed of the aeroplane in level flight be 50 miles an hour, and the aviator wishes to increase the speed by 20 miles per hour, he must dive at least 80 feet, assuming that the aeroplane falls freely, like a body *in vacuo*, or that its propeller overcomes the air resistance completely; otherwise the fall must be rather more than 80 feet.

A very instructive and spectacular contest could be arranged to determine which aviator could dive most swiftly and rebound most suddenly, the prize going to the one who should stress his machine most, as indicated by the accelerograph above proposed; but to avoid danger the contest would have to be supervised by competent experimentalists, and would best be conducted over water. It is safe to say that more than one well known aeroplane would be denied entry in such a contest, for lack of a sufficient factor of safety.

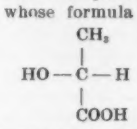
What the Mirror Does to You

(*Continued from page 190.*)

his clothing, only he would have to put his right glove on what used to be his left hand!

While there is a certain comic element in the point of view thus presented, it has as a matter of fact a number of important serious applications. The first point to note is that no ordinary operation, such as mere rotation or inversion, can possibly effect the change which the mirror produces. No turning or twisting of your right hand glove can ever make it into a left hand glove—except that one operation of "turning it inside out." With most ordinary objects this operation is of course quite impossible. Two ordinary objects therefore which are related to one another as the right hand is to the left, or in other words, as one object is to its mirror image, cannot by any sort of transposition be made to coincide, like two congruent figures of geometry.

This fact has found an interesting and important application in organic chemistry. It is found that certain chemical compounds occur in pairs, the two members of each pair being practically identical in all their properties, but while one rotates the plane of polarization of polarized light to the right, the other rotates the same by an equal amount to the left. Now the curious thing is observed, that in every case in which the formula of such a compound is known, it is found to contain a so-called asymmetric carbon atom, that is to say, one which is linked to four different groups or radicles. An example of this kind is lactic acid, whose formula is



It will be observed that the central carbon atom has four unlike groups attached to it. If a solid model of such a formula is made, with the links extending evenly out from the central carbon atom, it is found that there are two possible arrangements of the groups—and the two are related to each other as an object is to its mirror image, or as the left hand is to the right.

This is shown in our last illustration (Figs. 6 and 7), in which the central carbon atom of the lactic acid molecule is represented in the customary manner by a regular tetrahedron, or four-angled solid. Each corner of this tetrahedron represents one of the bonds or affinities of the central carbon atom. The four groups attached can be arranged in two and only two insuperposable arrangements, as shown, of which the one is the mirror image of the other.

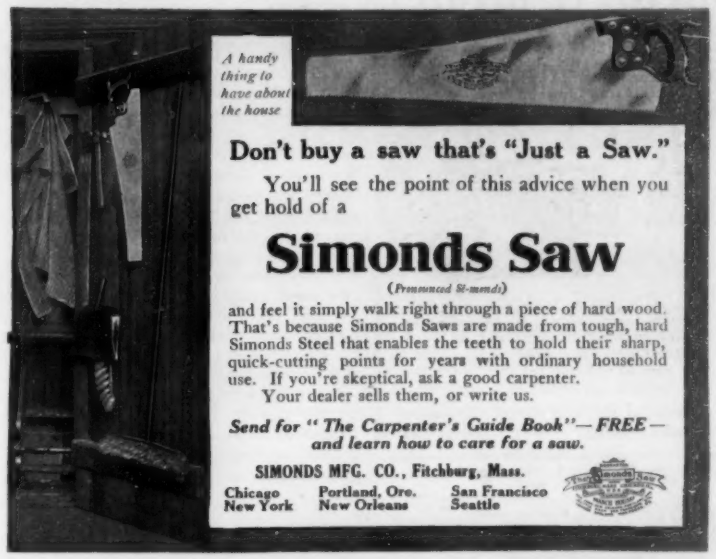
This is true only as long as the groups attached to the central carbon atoms are all dissimilar, as is the case in lactic acid. As soon as two or more of them are alike, only one arrangement is possible. The fact that such an "asymmetric" carbon atom occurs in all optically active carbon compounds whose formula is known (and they are exceedingly numerous) appears too significant to be ascribable to accident, and it is customary to regard the two twin forms—optical isomers as they are called—as represented by the two possible space formulæ, although there is at present no means of identifying each member of the pair of compounds with a particular one of these two formulæ.

The reader will recall that in analytical geometry also it is necessary to distinguish between two kinds of systems of rectangular co-ordinates, which are related to one another as object to image, or as the right hand is to the left hand. Here also the two arrangements are "insuperposable," and form two distinct systems. Since mathematical treatment extends to innumerable applications of all kinds in different branches of science, this relation of the object to its image is one of pretty general interest.

A Forest Service Circular on "Chaparral"

BULLETIN 85, entitled "Chaparral," by Fred G. Plummer, geographer of the Forest Service, is a publication dealing exclusively with a type of plant formation that has never before been made the subject of study. It is a work that is justly called the pioneer in its field. Chaparral is an Americanized term for a distinctive type of growth, which Mr. Plummer describes as a mixed forest of stunted trees, and is the result of peculiar climatic conditions. It forms an intermediate stage between a true desert and timberland. The author classifies wild lands into eight distinct types, as follows: desert, barren, grassland, sagebrush, brushland, chaparral, woodland and timberland. The first four and a part of the fifth do not bear trees, the balance are forested areas. Chaparral is, therefore, a general term for a type of mixed growth of stunted arborescent plants, and is not, as is generally supposed, a name given to one particular species of plants.

The circular deals with the natural and artificial forces now in operation, which tend to limit or extend the range of distribution of chaparral forming species. This includes, not only historical records of past forest conditions in a chaparral region, but also a consideration of its present condition in relation to forestry and conservation. Here the chief topics are geographical conditions in the chaparral area; chaparral and the water supply; vertical range of chaparral; composition of chaparral; amount of shade produced, and the value of the different species. Although the central feature of the treatment is the effort to keep clearly before the reader the value of chaparral as a conservator of water, Mr. Plummer also discusses the commercial uses of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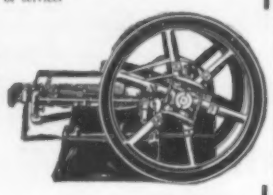

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some of the species for fuel, fencing, forage, bee-pasturage, etc.

The forester's point of view is also vividly illustrated in the chapters dealing with methods of protection against fire and artificial restocking of more valuable species after fires. Not only is the work entirely new in substance and its method of treatment, but it is fully abreast of the latest research, as shown particularly by the nomenclature of the species considered. The illustrations are numerous, wisely chosen and well executed. The pen drawings of the principal species of chaparral are excellent and all the half tones are clear. The addition of a small map engraved in colors, showing the distribution of chaparral, is a unique and valuable feature of the illustrations.

While this bulletin is intended primarily as a work for foresters in western United States and for forest students in general, and will probably be read chiefly by technical foresters, nevertheless its readable style, choice and arrangement of subjects and emphasis laid upon scientific accuracy, cannot fail to commend the publication to any one who may be interested in reading the story of our large areas of stunted forests in the West.

The Current Supplement

IN the companion issue, No. 1860, of our SUPPLEMENT, Harold J. Shepstone contributes an article on the Potter's Clay Industry.—A very interesting suggestion for a new method of estimating the duration of geological ages is made by Mr. Arthur Holmes.—We bring some new information regarding that important modern development, the Diesel engine, as applied to marine use.—The electrolytic smelting of iron has for some time been attracting attention. Consul L. J. Fuller, of Gothenburg, Sweden, reports on the production of pig iron by electricity.—The application of metallographic diagnosis to the effect of mechanical treatment on the structure of metals is discussed by our Paris correspondent.—The fifth instalment of Donald Murray's article on Printing Telegraphy appears in this issue.—The electric locomotive for the line running through the tunnel in the Lotschberg is described by our English correspondent.—Mr. Feldhaus gives us an illustrated account of the "Evolution of the Umbrella."—Prof. Wiener discusses some of the dangers of aeronautics, and remedies against them.—R. A. Smith gives an account of the highways which the Romans built through and about the present site of London.—A. E. Outerbridge discusses the uses and limitations of manganese and silicon in foundry practice.

An Exhibition of Labor-saving Appliances

THE United States Government Exhibit of Labor Saving Office Appliances was held on two floors of the Union Building in Washington city, July 6th to 15th, and the display is said to have equaled those of the Madison Square Garden and the Chicago exhibit of last March. Being held under government auspices the display involved no cost to the exhibitors for space, light or heat and the large market promised by the government service attracted manufacturers from all directions, the articles exploited ranging from lead pencils to the most complicated forms of apparatus employed in office work. Good attendance was assured as government employees received tickets for the exposition and were granted leave for the purpose of attending and opportunities were afforded for their recommending such appliances as appealed especially to them. Of the hundreds of appliances shown, it is doubtful if there is a single one which would not find a useful place in any large office establishment.

Exchange Professor in France.—The exchange of professors recently arranged between Harvard University and the French Ministry of Public Instruction goes into effect next winter, with W. M. Davis (recently exchange professor in Berlin) as the first exchange professor in France. Prof. Davis will lecture on land forms. Prof. Diehl, of the Sorbonne, will lecture on Byzantine history at Harvard.

Electricity

Fiftieth Anniversary of the Dynamo.—Fifty years ago Sr. Antonio Pacinotti invented the first commercial type dynamo. This event is soon to be celebrated in Pisa. At the time he invented the dynamo, Pacinotti was a student at the University of Pisa. He used a ring armature of the type now known as a "Gramme ring," having been reinvented by Gramme in 1870. It was not until 1881 that Pacinotti's dynamo attracted much attention, when, at the Paris Exposition, a diploma was awarded to the Italian inventor.

Railroad Car for Transformers.—A striking illustration of the enormous size of some of the transformers made in these days is shown by a new type of car built for transporting these transformers by rail. The car referred to is provided with a cut-out at the center, so that the floor is brought to within two feet, two inches of the tops of the rails, this being necessary to give sufficient clearance under bridges. The car is 35 feet 5 inches long, and in the cut-out portion will carry a load of 150,000 pounds.

Street Lamps of All Kinds in Chicago.—Figures given in the recent annual report of the Department of Electricity of Chicago, and quoted by the *Electrical World*, show that the total number of public street lamps in service on December 31st, 1910, was 37,994. Of these, 12,366 were municipal electric-arc lamps, 893 rented arc lamps, 11,990 gas-mantle lamps, 5,426 gas flat-flame lamps and 7,319 gasoline lamps. The cost of rented arc lamps is $75 a year, municipal arc lamps $61.95 a year, mantle gas lamps $18.91, open-flame gas lamps $15.41, and gasoline lamps $26.40.

An International Electric Railroad.—An electric railroad is to be built which will run in three countries, Italy, Switzerland and Austria, and it will greatly shorten up the distance by rail from Milan to Munich. On the Italian side it starts from Tirano, which is the terminus of the Valtellina electric road, and crosses the Swiss frontier by a five-mile tunnel through the mountains, reaching the Munster Valley. It then crosses into Austria to Mals, and this point will be connected to Landeck by a line which the Austrian Government is to build. This latter point lies on the railroad leading to Munich. It is probable that an electric section will be also run from Landeck to Munich.

Energy Generated in London and in New York.—The returns issued by the London County Council, and quoted by the *Electrical World*, relating to the amount of electricity generated in and around London, show that in London the borough councils generated or purchased 91,851,181 kilowatt-hours, of which 75,115,968 kilowatt hours, or 82 per cent, was sold. Information regarding the kilowatt-hours generated by the London companies is not available, but they disposed of 137,211,288 kilowatt-hours. Whether this included that used by the railways is not stated. In New York city the amount of energy generated by the public-utility companies last year is estimated to have been 1,750,000,000 kilowatt-hours.

Mechanical Ammeter.—A novel "current gage" has just been invented, which is designed to give a fair approximation of the current flowing through a conductor without cutting the conductor or interfering with its operation in any way. The device consists of a U-shaped magnet of laminated soft iron, secured to a handle, an arm is fulcrumed to the handle with one end serving as an armature directly over the poles of the magnet, and the other is fitted with a leaf spring engaged by a set screw on the handle, whereby the armature may be moved into or out of engagement with the poles of the magnet. If it be desired to measure the current in a conductor, the U-shaped part is placed over the conductor, and is electro-magnetically energized thereby. The set screw is then turned to force the armature away from the pole and when it has been moved far enough to spring away, the number of amperes passing through the conductor will be indicated by a hand on the set screw, which sweeps over a graduated dial.

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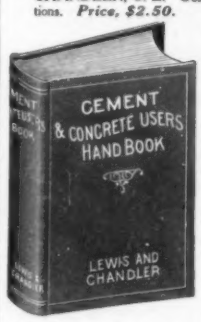

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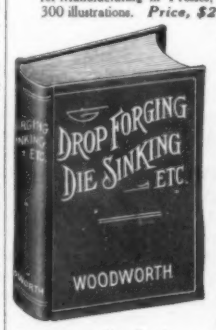

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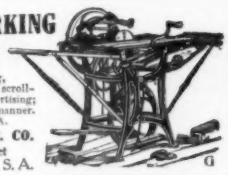

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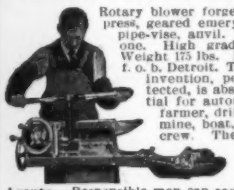

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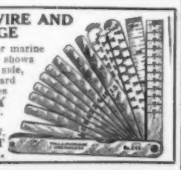

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Science

International Aeronautical Congress.—The fifth international aeronautical congress will meet at Turin October 25th to 31st, 1911, under the presidency of Commandant Renard. The last congress met at Nancy in September, 1909.

A Language of 300 Words.—In the more inaccessible parts of the Sierra Madre Mountains, in northern Mexico, live a curious people called the Tarahuamaris. Many of them dwell in caves, but they have also small villages, all of them about 8,000 feet above sea-level. The Tarahuamaris are small in body, but possessed of much endurance. Their only food is maize, and they manufacture a drink called teshuin, from the same cereal. Their language is limited to about 300 words, and they cannot count beyond ten.

Color-changing Paints.—Members of the Physical Society in London were greatly interested at a recent meeting by an exhibition of specimens of paints which change their color with variations of the temperature. One of these paints is red at ordinary temperatures, but turns black in a few seconds when warmed in front of a stove or otherwise heated to 206 deg. F. Another paint is yellow until heated to a temperature of 113 deg. F., when it becomes dark red. They are called "heat-indicating paints," but are little more than scientific curiosities.

Contaminating Gases Turned to Use.—An instance of the transformation by scientific means of a deleterious into a useful substance is furnished by a process employed in Germany in connection with the manufacture of superphosphate fertilizer where apatite is used. The large volumes of hydrofluoric acid that are given off seriously contaminate the atmosphere, but by the German process these gases are recovered in the form of fluosilicic acid, which is used in the manufacture of artificial stone for hardening soft limestone and sandstone, and for other purposes.

Filtered Water in Bamboo Stems.—Yapp, the English naturalist who has explored the mountain ranges of the Malay Peninsula, reports the fact, not generally known, that in several species of bamboo the hollow internodes—the parts of the stems between the joints—are stored with large quantities of naturally filtered water. The knowledge of this fact might be of great service in an emergency. Mr. Yapp also discovered, on his last visit, two species of ferns, growing on trees, whose thick, fleshy stems are filled with galleries tunneled by ants, the ferns thus forming living nests for the ants.

The John Scott Medal for McFarlan Moore.—Mr. D. McFarlan Moore has been awarded the John Scott Legacy Medal and Premium by the city of Philadelphia upon the recommendation of the Franklin Institute. The award is made in recognition of Mr. Moore's scientific investigations in the development of the art of vacuum tube lighting, covering a period of many years. Mr. Moore's system, as our readers know, consists briefly in converting electrical energy into light by passing an alternating current of electricity through rarefied gases in glass tubes. By a variation in composition of the gases in the tubes, and the degree of their rarefaction, the color and intensity of the light produced are controlled.

Fever in Plants.—Not only animals but plants may suffer and die of fevers, is the conclusion reached by the French savant Du Sablon. When a human being has a fever he loses flesh on account of the increased combustion, the quantity of carbonic acid respired from the lungs being augmented from 70 to 100 per cent. A plant attacked by a fever, which may be caused by a wound, rapidly consumes its reserves of organic matter and becomes enfeebled, sometimes sufficiently to cause its death. Du Sablon has experimented with potatoes rendered feverish by cutting them. The temperature soon rises about one degree, and the quantity of carbonic acid given off increases several hundred per cent. If the potato survives, its "respiration" after a few days becomes normal, but it falls into an enfeebled state, resembling that of a person convalescent from a long fever.

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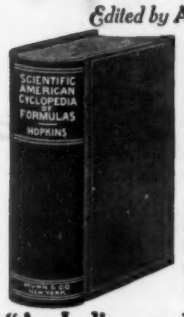

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Circulation

VIEWED FROM BEHIND THE SCENES

Why forced circulations are not worth one hundred cents on the dollar—Advertisers need to know not only how much the circulation is, but also how it was obtained.

By HENRY H. HOWER
Advertising Manager, The F. B. Stearns (Automobile) Co.

Slowly, but as surely as the passing of time, a new idea is making itself felt in advertising. That idea consists in paying for circulation according to the quality of the publication and its readers—not simply paying for so many sold copies. The time is steadily passing when so-many-thousand readers for such-and-such a rate can get any and all business. Thinking men are realizing the fact that the hundreds of thousands wasted in advertising can be diverted into producing channels. On every side this idea is cropping out.

A few years ago—and to-day in many cases—very large circulation meant heavy advertising patronage. In some cases this was justified, but very often it was quite the reverse. More and more advertising managers are commencing to think more deeply and to analyze statements which before they had taken for granted.

Probably the best example of this class of advanced thinker is E. St. Elmo Lewis. Mr. Lewis is outspoken in his denunciation of the old method. "It is the most erroneous idea in advertising," Mr. Lewis said, recently. "There is no sense in buying circulation merely as circulation—it is what composes that circulation that counts. I wouldn't give two cents for a hundred thousand circulation if I had no way of knowing or finding out something *about* that circulation."

There are publications of 50,000 in this country whose columns are worth more to the majority of advertisers than others of double, and even treble that figure. Personally, I would willingly pay *twice as much* for space in the former as in the latter. And the time is coming when *valuable* circulation—among *quality* readers—will win its own battle.

Listen: Several years ago I became connected with a small semi-trade paper in an executive capacity. Shortly after taking up my work, there came one day the representative of a "subscription and circulation bureau." To cut a long story short, he offered to get me *as many thousand subscriptions as I wanted*—in any State or States desired—to deliver them within sixty days and to conform to the post-office regulations. All this without any effort on my part, but with considerable expense. Suppose all this had been done—the circulation boosted to ten or fifteen thousand—aggressive advertising men put in the field. The business would have come in, without doubt.

How is the advertising manager to know that some of the various publications he is using are not doing these very things? This may seem an extreme position, and it is doubtless open to criticism, but there is more truth in it than many will care to admit.

I know of a certain publication selling for something like fifty cents a year which has recently secured contracts for automobile advertising. Cannot the wisdom of the selection of such a medium as this be criticised?

A little test I made of a large list of publications shook up my ideas in a good many ways. But above everything else I found that there was a greater difference between well-known periodicals than I had dreamed of before. The idea of paying for *the quality* of the publication and its readers means a good deal more to me now than it did then.

And one thing more. Quality circulation cannot be forced. A publication of little merit cannot get—*and hold*—such readers. It's the genuine merit of the publication that is responsible and there is setting in a strong drift toward those publications which have this merit.—(*From Printers' Ink, July 6, 1911.*)

HARPER'S MAGAZINE

Thirty-five cents a copy **Four dollars a year**

If you care to know more about this—write

Overland

30 Horse-Power Five-Passenger Fore-Door Touring Car—$900

A MONTH ago we made the first announcement of this car. Our prediction came true. The entire industry sat up and had a good look. The day of that announcement dealers wired from almost every section of the country. They came to the factory in droves. Agents that last season bought 100 cars this year contracted for 150 and 200. The dealers from the metropolitan centers advanced their orders in proportion. Others that formerly contracted for 1000 cars signed up for 1500 for 1912. In one week we signed up nearly 8000 cars. One of our dealers alone takes more cars than most manufacturers turn out in a year. For the coming season eighteen hundred dealers throughout America will handle the Overland line.

This car is now ready for demonstration. If the Overland dealer in your town hasn't received one he will in a few days. Wait and see it. To fully understand the exceptional value of this car you have but to compare it with what the entire market has to offer for 1912. Study the specifications below carefully. In what other car will you find such value at such a price? What machine under $1250 can you line up against this and item for item see so much for so little money. When you stop to consider the fine, thorough construction—the heavy drop forgings—the pressed steel frame—the selective transmission fitted with F. & S. annular bearings (which the most expensive cars in the world use)—the 30 horsepower motor, the big wheel base, the fore-door body with door handles and all levers inside the car, you can better realize what an actual advanced manufacturing step this new car is. It is doubtful if any one ever expected so much in an automobile for such a small price.

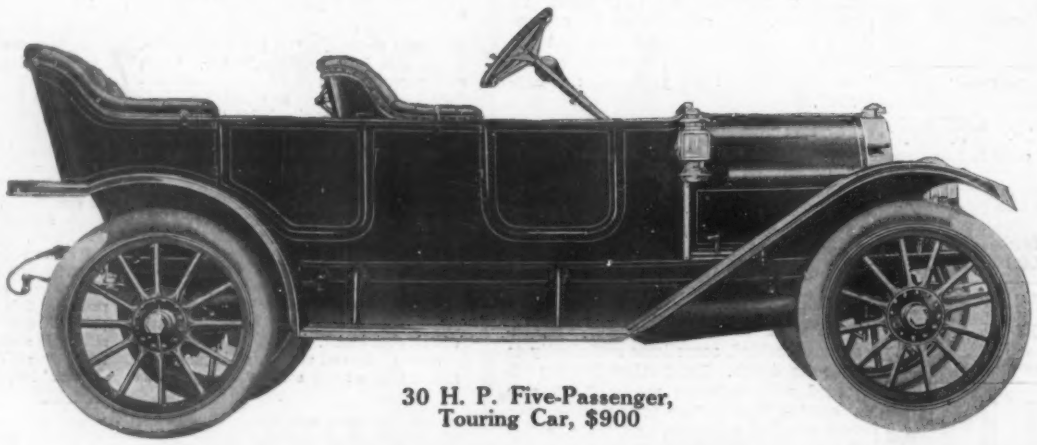
We urge upon anyone who feels at all doubtful about this statement to take the announcement of any other standard maker and see what he has to offer. Just make a few straight comparisons. Take any other car—compare the wheel base—the size of the motor—the body—the design—the finish—the seating capacity. See if you can purchase this car below $1250. And go further than that—find out how the other cars are made and what they are made of. This will reveal some interesting facts about the economical manufacturing strength of the Overland organization.

Our 1912 catalogue is now off the press. It explains exactly why no other maker in the business can produce this car to sell at this price without losing money. Write for a copy today.

SPECIFICATIONS OF MODEL 59

Wheel base, 106 inches; body, five-passenger fore-door touring; motor, 4x4½; horse-power, 30; transmission, selective, three speed and reverse, F. & S. annular ball bearings; ignition, Dual, Splitdorf magneto and batteries; front axle, drop forged I-section; rear axle, semi-floating; wheels, artillery wood, 12-1½ inch spokes, 12 bolts each wheel; tires, 32x3½ inches Quick Detachable; frame, pressed steel; finish, Overland blue; equipment, three oil lamps, two gas lamps and generator; tools, complete set; price, $900.

The Willys-Overland Company, Toledo, Ohio



30 H. P. Five-Passenger, Touring Car, $900